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A

MEDICAL MANUAL.

A

MEDICAL MANUAL

FOR

APOTHECARIES' HALL

AND

OTHER MEDICAL BOARDS.

BY

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ETC. ETC.

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PREFACE.

The publication of the Twelfth Edition of a work would appear to require no apology; but for the Author's sake it demands a few explanatory observations.

The object of this work is to supply an outline of the principal subjects insisted upon at Medical Examinations, to be used most as a syllabus, and never intended to convey an impression that so few pages are sufficient for all the purposes of the student. The Author has always felt, and recommended in his private instructions, that Gentlemen should peruse and study deeply the very valuable works which are published upon all the subjects treated of in this volume, and hopes that it will not be invidious to mention the works of Fownes, Turner, and Brande on Chemistry; Mr. Phillips's Translation of the Pharmacopœia; Dr. Pereira on Materia Medica; Dr. Quain's Anatomy; Dr. Carpenter, or Dr. Kirkes on Physiology; Dr. Christison on Poisons; Dr. Taylor's Forensic Medicine; Dr. Watson on Practice of Medicine; Professor Lindley on Botany; and numerous excellent authors upon Midwifery, &c.

In the first part a translation is given of the notes appended to the substances mentioned in the Lists of Drugs of the Pharmacopœia; the translation is so literally rendered, that, read by itself, it may appear quaint and pedantic. The Decompositions are described briefly, and the intention has been to render them intelligible and simple; but when not so, the reader is recommended to refer to Mr. Phillips's Translation of the Pharmacopœia, with which work the Author has generally made his Atomic Numbers to harmonise.

The CHEMISTRY is arranged chiefly in accordance with the views of Dr. Turner, and, in the latter part more especially, with the work of the late Dr. Fownes, which is the most recent summary of the state of chemical science.

The TOXICOLOGY consists of short notes, such as a student would probably select for himself, and find most interesting.

In the MATERIA MEDICA the Author has embodied the greater part of a work which he previously published separately, upon this subject.

In ANATOMY, the department looked upon as most strictly medical, has almost alone been treated of, and has been arranged so as to simplify as much as possible, the description of the several parts.

In the PRACTICE OF MEDICINE, it is requested that it be considered purely as a series of short descriptions and definitions of diseases, which can only be known properly by bed-side practice, and repeated inspection of post-mortem appearances.

On the subject of MIDWIFERY some short notes are appended, only upon the principal and most interesting topics.

In BOTANY, a small outline of the science is given, such as the Author hopes will stimulate the student, and excite a desire to prosecute the subject much further, by procuring and deeply studying the excellent works of Professor Lindley on this subject.

Lastly, the Author claims indulgence for many omissions on subjects which he intended to have introduced, which he knows will be readily accorded by all who are conversant with the arduous duties of his professional engagements.

2, *Southampton Street, Bloomsbury Square*;
November, 1858.

MEDICAL MANUAL.

London Pharmacopœia.

NOTES CONCERNING THE CATALOGUE OF DRUGS IN THE LONDON PHARMACOPŒIA.

ACETUM BRITANNICUM. Dilute and impure Acetic Acid, prepared by fermentation from an infusion of malt.

Qualities.—Brownish, with a peculiar odour; the specific gravity is 1·019. A fluid ounce of it is saturated by a drachm of the crystals of carbonate of soda. If, indeed, after ten minims of the solution of chloride of barium have been added to the same measure, more of the chloride be dropped into the filtered vinegar, nothing further is precipitated. The colour is not changed by hydrosulphuric acid.

Observations.—The strength is ascertained by the quantity of carbonate of soda saturated by it. The chloride of barium refers to sulphuric acid, which is almost always present in British vinegar; and if the second part added produces no precipitate, it shows that no more sulphuric acid is present than is allowed by law, viz.—one part of sulphuric acid in 1000 parts of vinegar. Hydrosulphuric acid shows the absence of metallici mpurities. This vinegar contains about 5 per cent. of pure acetic acid.

ACIDUM ACETICUM. An Acid prepared from wood by heat; purified Pyroligneous Acid.

Qualities.—It is free from colour, with a very sharp odour. Its specific weight is 1·048. By heat it passes into vapour. Nothing is precipitated from it by nitrate of silver or chloride of barium added to it. Silver leaf being digested with it, and hydrochloric acid afterwards dropped in, nothing is precipitated. The colour is changed neither by hydrosulphuric acid, nor ammonia, nor by ferrocyanide of potassium, after the addition of ammonia. One hundred grains of this acid are saturated by 87 grains of the crystals of carbonate of soda.

Observations.—Passing into vapour by heat shows the absence of any fixed salts. Nitrate of silver refers to hydrochloric acid, chloride of barium to sulphuric acid. The silver leaf and hydrochloric acid show the absence of nitric acid. Hydrosulphuric acid refers to metallic impurities, ammonia and the ferrocyanide of potassium refer to copper. It contains 30 per cent. of real acid.

ACIDUM ARSENIOSUM. A Metallic Acid prepared by sublimation.

Qualities. — White, or scarcely yellowish, generally opaque, but sometimes when fresh broken, more or less transparent. Heated in a glass tube, it is sublimed of a white colour; soon afterwards, when it has become cool, it is changed into colourless octohedral crystals. Mixed with charcoal and exposed to heat, it is reduced to arsenicum, and is sublimed, exhaling an alliaceous odour. Afterwards, when it has become cold, it adheres to the tube, shining like a metal. It is dissolved in boiling water, from which, when cooled, it falls in octohedral crystals. This solution gives a yellow precipitate with hydrosulphuric acid; with nitrate of silver and ammonia, a lemon-yellow precipitate; and with sulphate of copper and potash, a green precipitate. If 100 grains of this acid be boiled in dilute hydrochloric acid, and when the solution has become cold, hydrosulphuric acid be mixed with it, 124 grains of the tersulphuret of arsenicum are precipitated.

Observations.—The above requires no comment, as it fully explains the properties of arsenious acid.

ACIDUM BENZOICUM. An Acid prepared from Benzoin by sublimation. Crystalline.

Qualities.—It is white, or nearly white; by heat, carefully applied, it flies off, exhaling a peculiar odour. It is sparingly dissolved in water, copiously in rectified spirit. The same is dissolved in solution of ammonia, potash, soda, and lime; and is precipitated from each of them by hydrochloric acid.

Observations.—With the above alkaline solutions, benzoic acid forms benzoates; and when the hydrochloric acid is added, decomposition ensues, and the products are, a chloride of potassium, sodium, or calcium, and water, with benzoic acid set free, and which, from its sparing solubility, is soon precipitated. In the case of benzoate of ammonia, hydrochlorate of ammonia is formed, and benzoic acid is set free.

ACIDUM CITRICUM. An Acid prepared from the juice of the fruit of Citrus Limonum and other species. Crystals.

Qualities.—It is free from colour; by fire the whole, or nearly all, perishes. It is dissolved in water and spirit; that which is thrown down by the acetate of lead is dissolved by nitric acid (showing the absence of sulphuric acid). No salt prepared from potash, except the tartrate, throws down anything (showing the absence of tartaric acid). Sparingly added to cold lime water, it does not make it turbid (also showing the absence of tartaric acid). One hundred grains of it, dissolved in water, are saturated by 205·7 grains of crystallized carbonate of soda.

ACIDUM GALLICUM. Gallic Acid, prepared from the Gall-nut. Crystals.

Qualities.—Free from colour; is decomposed by fire; is dissolved in water and rectified spirit. It stains the preparations of sesquioxide of iron, dissolved in water, with a blue-black colour; but throws down no precipitate with a solution of isinglass.

Observations.—The isinglass, *alias* gelatine, especially distinguishes gallic from tannic acid.

ACIDUM HYDROCHLORICUM. An Acid, prepared from the Chloride of Sodium.

Qualities.—Free from colour; its specific weight is 1·160; exposed to the air it gives off very pungent white vapours; by heat the whole passes into vapour. The same mixed with water throws down nothing, either by the chloride of barium, ammonia, or sesquicarbonate of ammonia added to it (showing, firstly, the absence of sulphuric acid, and the rest referring to metallic or earthy impurities). It has no action upon gold leaf, even if boiled with it; nor is anything precipitated if ever afterwards protochloride of tin be added. It does not remove the colour from the solution of sulphate of indigo. (The gold leaf and sulphate of indigo show the absence of free chlorine). One hundred grains of this acid are saturated by 132 grains of the crystals of carbonate of soda.

ACIDUM NITRICUM. Nitric Acid, prepared from the Nitrate of Potash.

Qualities.—Free from colour; its specific gravity is 1·420; exposed to the air it gives out very pungent vapours; by heat the whole passes into vapour. Diluted with three parts of water by measure, it throws down nothing with nitrate of silver, or the chloride of barium (showing the absence of hydrochloric and sulphuric acids). One hundred grains of this acid are saturated by 161 grains of the crystals of carbonate of soda.

ACIDUM SULPHURICUM. An Acid prepared from Sulphur.

Qualities.—It is destitute of colour and smell. The specific gravity is 1·843. Mixed with an equal measure of water, it throws down a white precipitate (showing the presence of sulphate of lead), but emits no odour of nitrous acid (showing the absence of nitric acid). When diluted with twelve parts of water, it throws down no yellow precipitate with hydrosulphuric acid (thus proving that it contains no arsenious acid). One hundred grains of this acid are saturated by 285 grains of the crystals of carbonate of soda.

ACIDUM TANNICUM. An Acid prepared from Galls.

Qualities.—It is almost destitute of colour; dissolved in water, it is strongly astringent. It throws down a whitish precipitate from the solution of isinglass. In other respects it has the same reaction as gallic acid.

ACIDUM TARTARICUM. An Acid prepared from the Bitartrate of Potash. Crystals.

Qualities.—Void of colour. The whole, or almost all, is destroyed by the fire. It is dissolved in water. From any neutral salt of potash it throws down the bitartrate. Nothing ought to be thrown down by chloride of barium; and what is thrown down by the acetate of lead, should be dissolved by nitric acid (showing the absence of sulphuric acid and sulphates). One hundred grains of this acid are saturated by 192 grains of the crystals of the carbonate of soda.

ÆTHER. Æther prepared from Alcohol by the aid of Sulphuric Acid.

Qualities.—Free from colour. Its specific weight does not exceed ·750; (if heavier, water or alcohol is present). Exposed to the air it passes into vapours: it stains litmus with a red colour, either not at all or very slightly. There is need of half a pint of water, with which a fluid ounce of this can be united. If less be required to mix with it thoroughly, water or spirit will be present.

LIQUOR AMMONIÆ. Solution of Ammonia.

Qualities.—Free from colour. Its specific gravity is ·960. Exposed to the air it passes off in very pungent volatile alkaline vapours, turmeric being a test of it. Lime water being added, it throws down nothing (showing the absence of carbonic acid); it is not coloured by hydrosulphuric acid (showing the absence of metallic impurities); nor, when it has been saturated with nitric acid, does it throw down anything by either sesquicarbonate of ammonia, or nitrate of silver, or chloride of barium (showing the absence successively of earthy impurities, hydrochloric and sulphuric acids). In 100 grains of it, nearly 10 grains of ammonia are contained.

LIQUOR AMMONIÆ FORTIOR. Stronger Solution of Ammonia.

Qualities.—The specific weight of this is ·882. This solution may be reduced to the standard of the liquor ammoniæ by two ounces of water added to each ounce of it. Nearly 30 grains of ammonia are contained in an ounce of it.

AMMONIÆ SESQUICARBONAS. Crystallized Sesquicarbonate of Ammonia.

Qualities.—Free from colour; transparent; has a sharp odour and taste; changes the colour of turmeric into brown; is dissipated by heat; and is soluble in water. Nitric acid having been added to saturation, nothing is thrown down by chloride of barium (showing the absence of sulphuric acid), or by nitrate of silver (showing the absence of any hydrochlorate).

AQUA DESTILLATA. Distilled Water.

Qualities.—Lime water, or chloride of barium, or nitrate of silver, or oxalate of ammonia, or hydrosulphuric acid being added, it remains transparent (showing successively the absence of carbonic acid, sulphuric acid, any chloride, lime, or metallic salts).

ARGENTI NITRAS. Fused Nitrate of Silver.

Qualities.—White; it is dissolved in water. This solution precipitates silver, metallic copper being put into it. If, after 17 grains of nitrate of silver have been added to 6 grains of chloride of sodium dissolved in water, more nitrate of silver be dropped in the filtered liquid, nothing is precipitated (showing that the salt was not adulterated with nitrate of potash or other nitrate). Let the access of light be excluded.

CALAMINA PRÆPARATA. The native Carbonate of Zinc, burnt, rubbed into a very fine powder, and elutriated.

Qualities.—Nearly the whole of it is dissolved in dilute sulphuric acid, emitting none, or very few, bubbles of carbonic acid (showing the absence of carbonate of lime). This solution, on the addition of ammonia or potash, throws down a precipitate, which is dissolved by either added in excess (showing the absence of any iron or other metallic impurity).

CALX. Lime recently procured from Chalk.

Qualities.—Slaked by water added to it, it breaks down into a powder. It is dissolved by dilute hydrochloric acid without effervescence (showing the absence of any carbonate). This solution throws down nothing by ammonia added to it in excess (showing the absence of iron, alumina, or phosphate of lime).

CREASOTON. An Oxy-hydro-carburet prepared from Pyroxylic Oil.

Qualities.—It is free from colour, with a peculiar odour; is dissolved in acetic acid. The specific weight of it is 1·046. When it has been dropped upon bibulous paper, if a boiling heat be applied for a little time, it flies off, and does not leave behind a transparent spot (this shows that it is not adulterated with any common fixed oil).

CRETA PRÆPARATA. Friable Carbonate of Lime rubbed into a very fine powder, and elutriated.

Qualities.—Nearly the whole of it is dissolved in hydrochloric acid, giving out bubbles of carbonic acid. This solution throws down nothing, either by hydrosulphuric acid (showing the absence of lead or other metallic impurity), or when it has been boiled, by ammonia or lime added in excess (showing the absence of iron, alumina or phosphate of lime).

HYDRARGYRUM. Strained Quicksilver.

Qualities.—Its specific gravity is 13·5. By heat it passes into vapour (showing the absence of other metals). Not the smallest part of a globule gently driven about on a sheet of paper, adheres to the sheet.

IODINIUM. Crystallized Iodine.

Qualities.—Black, it resembles metals in its lustre, and chlorine in its odour. By heat applied, it first melts, afterwards is sublimed in a violet vapour. It is dissolved in rectified spirit. This solution stains starch with a blue colour. Thirty grains of iodine dissolved in three ounces of water at a gentle heat together with nine grains of lime, stain the solution with a yellow or brownish colour.

MAGNESIÆ SULPHAS. Sulphate of Magnesia. Crystals.

Qualities.—It does not deliquesce in the air; it is dissolved in water. Sulphuric acid being dropped into a solution of it, no hydrocloric acid is evolved (showing the absence of chloride of sodium or magnesium).

MEL. Honey. A liquid from flowers deposited in the honey-comb by the Apis Mellifica, and clarified.

Qualities.—If it be dissolved in water, nearly at the 170th degree of heat, and, when cooled, it be mixed with iodide of potassium and dilute nitric acid, it exhibits in no degree a blue colour (showing that it has not been adulterated with flour or starch).

PLUMBI ACETAS. Acetate of Lead. Crystals.

Qualities.—It is dissolved in water. That which is thrown down from this solution by the carbonate of soda is white (carbonate of lead); and that by the iodide of potassium is yellow (iodide of lead). Moreover it becomes black by hydrosulphuric acid (forming sulphuret of lead). Sulphuric acid added to it eliminates acetous odours. From 100 grains of it dissolved in water, sulphate of soda being added to it, 80 grains of the sulphate of lead are precipitated.

PLUMBI OXIDUM. Semi-vitreous Oxide of Lead.

Qualities.—The whole, or nearly the whole, of it is dissolved in dilute nitric acid. This solution becomes black by hydrosulphuric acid put into it. That which is thrown down by potash is white (hydrated oxide of lead), and is again dissolved by the same added in excess. From 100 grains of this oxide dissolved in dilute nitric acid, 135 grains of the sulphate of lead are precipitated by sulphate of soda added to it.

POTASSÆ BICARBONAS. Bicarbonate of Potash. Crystals.

Qualities.—It is dissolved in water. This solution slightly changes the colour of turmeric to brown. The sulphate of magnesia throws down nothing from the solution, unless heat be applied (showing the absence of carbonate). Nitric acid being added, there is effervescence, and when the same is added to complete saturation, there is no precipitate with the chloride of barium or nitrate of silver (which proves the absence of soluble sulphate of potash or chloride of potassium). In a strong fire 30·7 per cent. of carbonic acid and water are expelled.

POTASSÆ BITARTRAS. Bitartrate of Potash. Crystalline.

Qualities.—It is sparingly soluble in water. The solution stains litmus with a red colour. In a strong fire it is reduced to carbonate of potash.

POTASSÆ CHLORAS. Chlorate of Potash. Crystals.

Qualities.—It is dissolved by water. The solution throws down nothing with the solution of nitrate of silver (proving the absence of chloride of potassium). By heat it melts, and in a strong fire it gives out about 39 per cent. of oxygen. A few minims of sulphuric acid being dropped on the crystals, this salt first turns yellow, then becomes red, and evolves yellow vapours of peroxide of chlorine. Rubbed with sulphur it fulminates.

POTASSÆ NITRAS. Nitrate of Potash. Crystals.

Qualities.—It is dissolved by water. From the solution nothing is thrown down, either by the chloride of barium, or the nitrate of silver. By heat it melts, but loses nothing of its weight; a stronger heat causes the evolution of oxygen. From the remaining salt (after it has been heated) sulphuric acid eliminates nitrous vapours. Placed on a burning coal it deflagrates, carbonate of potash being left. From 100 grains digested in sulphuric acid, there are procured 86 of sulphate of potash dried at a red heat.

POTASSÆ SULPHAS. Sulphate of Potash. Crystals.

Qualities.—It is sparingly soluble in water. What is thrown down from this solution by the bichloride of platinum is of a yellowish colour. The precipitate with chloride of barium is white, and is not dissolved in boiling nitric acid. (These are tests for the potash and the sulphuric acid.) When heated it crepitates, and at a red heat it melts, losing none of its weight (thus proving the absence of water). From 100 grains of this salt, digested with chloride of barium and hydrochloric acid, 132 grains of sulphate of baryta dried at a red heat are obtained.

POTASSÆ TARTRAS. Tartrate of Potash.

Qualities.—Is soluble in water. The solution neither changes the colour of litmus nor turmeric paper. On the addition of almost any acid it throws down crystals of the bitartrate of potash, which, for the most part, adhere to the side of the vessel. The precipitate thrown down from a solution of this salt in water, either by the chloride of barium or the nitrate of silver, is readily soluble in nitric acid (showing the absence of sulphates or chlorides).

POTASSII FERROCYANIDUM. Ferrocyanide of Potassium. Crystals.

Qualities.—This salt is of a yellow colour and dissolved by water. The solution is not changed on the addition of any alkali, or the infusion of galls. The precipitate occasioned by the sulphate of iron is first of a white colour and soon turns blue. The precipitate caused by sulphate of copper is of a brown colour, that by sulphate of zinc is white. Subjected to a gentle heat it loses its colour, and 12·6 per cent. of water of crystallization. It is decomposed by a red heat, and what remains is soluble in hydrochloric acid, and is again precipitated by ammonia. From 100 grains of it, 18·7 grains of the sesquioxide of iron may be prepared. Lastly, if it be boiled with sulphuric acid, it gives out the odour of hydrocyanic acid.

POTASSII IODIDUM. Iodide of Potassium. Crystals.

Qualities.—It is soluble in six or eight parts of rectified spirit, copiously in water. It ought not to change the colour of turmeric if pure, nor to exercise any influence on litmus. On the addition of starch and sulphuric acid it gives a blue colour (from the evolution of iodine, and its action on the starch). The precipitate occasioned by acetate of lead is yellow (iodide of lead), and is soluble in boiling water, but nothing is thrown down, either by solution of lime or chloride of barium (showing the absence of carbonates and sulphates); what is thrown down by nitrate of silver, when redissolved by liquor ammoniæ, is not precipitated by the addition of nitric acid.

(This shows the absence of chlorine and its salts.) 141 grains of the iodide of silver are thrown down from a solution of nitrate of silver on the addition of 100 grains of this salt.

QUINÆ DISULPHAS. Disulphate of Quinine.

Qualities.—It is dissolved in water, especially when mixed with an acid. Quina is precipitated by ammonia added to this; then the solution being evaporated, that which is left ought not to taste of sugar (showing that sugar has not been used to adulterate it). One hundred grains of disulphate of quina emit, by a gentle heat, 8 or 10 grains, by weight, of water. It becomes green by chlorine (recently obtained), and afterwards by ammonia added to it. From 100 grains of it dissolved in water, mixed with hydrochloric acid, chloride of barium being added to it, 26·6 grains of sulphate of baryta, dried at a red heat, are produced. If a larger quantity be obtained, some other soluble sulphate will have been used to adulterate it.

SCAMMONIUM. Scammony.

Qualities.—Porous, brittle, and shines where fresh broken. It emits no bubbles by hydrochloric acid dropped upon it (showing the absence of chalk); nor is the water in which, previously bruised, it may have been digested, with a heat of 170°, tinged with a blue colour, by iodide of potassium and dilute nitric acid added at the same time (showing the absence of flour or starch). From 100 grains of it, 78 ought to be dissolved by æther.

SODÆ BICARBONAS. Bicarbonate of Soda.

Qualities.—It is dissolved in water; it slightly changes the colour of turmeric to brown. From this solution neither bichloride of platinum, nor sulphate of magnesia, throws down anything unless heat be applied. (The bichloride shows the absence of potash; the sulphate of magnesia, without heat, shows that the salt is not the carbonate.) That which the chloride of barium throws down is dissolved in hydrochloric acid (showing the absence of any sulphate). One hundred grains of this give off 51·7 of carbonic acid, by dilute sulphuric acid added to it.

SODÆ CARBONAS. Carbonate of Soda.

Qualities.—Free from colour; transparent; exposed to the air it soon crumbles into a powder. It is dissolved in water. This solution changes the colour of turmeric to brown. When it has been supersaturated with hydrochloric acid, the chloride of barium throws down nothing from it (showing the absence of sulphuric acid). One hundred grains of carbonate of soda, by a brisk fire, lose 62·5 grains: an equal quantity of dilute sulphuric acid being added, it gives out 15·28 grains, by weight, of carbonic acid.

SODÆ PHOSPHAS. Phosphate of Soda. Crystals.

Qualities.—It effloresces slightly when exposed to the air. It is soluble in water; the solution slightly changes the colour of turmeric to brown. The precipitate thrown down from it by the chloride of barium is soluble in nitric acid, without effervescence; the yellow precipitate thrown down by nitrate of silver is also soluble in the same acid. It loses 62·3 parts per cent. in a brisk fire. The precipitate from the remaining salt, with nitrate of silver, is white (*i. e.* the acid has been rendered bibasic by application of heat to it).

SODÆ POTASSIO TARTRAS. Potassio Tartrate of Soda. Crystals.

Qualities.—It is soluble in water. This solution neither changes the colour of litmus nor turmeric. On the addition of sulphuric acid, the bitartrate of potash is thrown down; nitrate of silver, or chloride of barium being added to it, nothing is precipitated, or if anything, it is dissolved in water (showing the absence of chlorides or sulphates).

SODÆ SULPHAS. Sulphate of Soda. Crystals.

Qualities.—Exposed to the air, it breaks down into a powder. It is dissolved in water. This solution neither changes the colour of litmus nor turmeric (showing its neutrality). From the diluted solution nitrate of silver throws down scarcely anything (showing the absence of chlorides). In a brisk fire, it loses 55·5 of water out of 100 grains. Moreover, from 100 grains of it, dissolved in distilled water, chloride of barium and hydrochloric acid having been added, 71 grains of sulphate of baryta, dried by a brisk fire, are produced.

SPIRITUS RECTIFICATUS. Diluted Alcohol.

Qualities.—The specific gravity of this is ·838. It is not coloured by water being added to it (showing the absence of dissolved impurities); nor is it tinged red by sulphuric acid. Rectified spirit can be reduced to the standard of proof spirit by adding three pints of distilled water to five pints of rectified spirit, at a temperature of 62°.

SPIRITUS TENUIOR. Proof Spirit (Alcohol more diluted).

Qualities.—The same as those of the above, but weaker. The specific gravity is ·920.

STRYCHNIA. An Alkali prepared from the Nux Vomica.

Qualities.—It is soluble in boiling rectified spirit. By heat it melts, and at a higher temperature it is entirely destroyed. It tastes extremely bitter. Being endowed with violent properties, it is to be administered very cautiously.

SULPHUR. Sublimed Sulphur.

Qualities.—This ought to be of a lemon colour, and is sublimed at a heat of 600 degrees. It is soluble in oil of turpentine, by the aid of heat.

SULPHUR PRÆCIPITATUM. Precipitated Sulphur.

Qualities.—Its colour is a pale yellow. Water with which it is boiled does not change the colour of litmus to red (thus showing the absence of sulphurous, sulphuric, or hydrochloric acids). In other respects it answers to sulphur mentioned above.

VERATRIA. An Alkali prepared from the seed of the Asagræa Officinalis.

Qualities.—It is very slightly soluble in water, more so in æther, but most in rectified spirit. It has no smell, but violently irritates the nostrils. It tastes acrid. It is to be employed with the utmost caution.

ZINCI SULPHAS. Sulphate of Zinc. Crystals.

Qualities.—It is soluble in water. The precipitate with ammonia is white (oxide of zinc), and is redissolved in excess of the precipitant. The precipitate with acetate of lead or chloride of barium is not soluble in dilute nitric acid (being sulphate of lead or baryta). The precipitate with carbonate of ammonia from 100 grains of sulphate of zinc is, by a great heat, reduced to 27·9 grains of the oxide of zinc.

ZINCUM. Zinc.

Qualities.—The specific gravity is 6·86. It is soluble in nitric acid. From the solution, the precipitate by liquor ammoniæ, is soluble in excess of the precipitant.

CHEMICAL DECOMPOSITIONS.

ACETUM DESTILLATUM.

By distilling vinegar, acetic acid with water, a slight quantity of mucilage and a little alcohol pass over in the first seven pints into the receiver, leaving the heavy impurities in the retort. If the heat were continued, the acetic acid would be coloured, and obtain an empyreumatic odour, resulting from decomposition of mucilaginous matter.

Vinegar is made either from malt-liquors, weak wines, or various fruits, such as gooseberries, &c. Hence it may contain, amongst its impurities, mucilage, colouring matter, a little alcohol, sometimes malic or tartaric acid; and in our own country we find sulphuric acid, on account of the law allowing one part of it to be added to 1000 parts of vinegar. We also find in vinegar, on some occasions, metallic impregnations, as of copper, lead, and tin, arising from the vessels which have been employed in preparing it. They may be discovered by their appropriate tests. The strongest vinegar contains about 5 per cent. of real acetic acid, and a fluid ounce of it should be neutralized by 57 grains of carbonate of soda. When a solution of chloride of barium is added to an ounce of vinegar, the precipitated sulphate of baryta should not exceed 1·14 grains. Should hydrosulphuric acid occasion no precipitate, it proves the absence of metallic salts.

Medical Uses.—Vinegar is refrigerant, and considered to be antiseptic. It is seldom used much internally. Dr. Thompson recommended it during the administration of acetate of lead, with the idea of preventing that salt being converted into a carbonate. It is often used in the form of vapour in sore throats; externally, in lotions, for sponging the chest in some pulmonary diseases, or the body generally in fever. In fever it is often sprinkled about rooms, with the impression that it has disinfecting qualities.

Distilled vinegar is now seldom employed in pharmacy, in consequence of the greater purity of dilute acetic acid of the present Pharmacopœia.

Dose.—ʒj to ℥ss of vinegar.

Prep.—Ceratum Saponis Comp., Linimentum Æruginis.

ACIDUM ACETICUM. (Ph. L., 1836.)

Ingredients :

Acetate of Soda,
Sulphuric Acid,
Distilled Water.

Decomposition.—The sulphuric acid, from its greater affinity, unites with the soda, forming sulphate of soda; the acetic acid is set free, and is separated by distillation. The heat should not be pushed too far, for fear of decomposing even the sulphate of soda.

Acetate of soda is obtained in the following manner: by submitting wood to destructive distillation, an acid, named pyroligneous or acetic, is generated, contaminated with tarry matter. To this, lime is first added, to form an acetate of lime, and subsequently sulphate of soda, when double decomposition ensues, affording acetate of soda and sulphate of lime. The soluble acetate is removed, and heated so as to expel the water and tarry matter, and repeatedly dissolved and crystallized, until quite pure.

The acetic acid has a specific gravity of 1·048. It is very volatile: when heated, its vapour is combustible; 100 grains of it saturate 87 grains of crystals of carbonate of soda. It contains 30 per cent. of real acid.

Anhydrous acetic acid is composed of—

3 oxygen $3 \times 8 = 24$
3 hydrogen $3 \times 1 = 3$
4 carbon $4 \times 6 = 24$

Atomic number . . 51

Formula—$C^4 H^3 O^3$.

Medical Uses.—This liquid, applied to the skin, acts as a rubefacient, and even raises a blister. It is also a mild escharotic. It is chiefly employed in pharmacy.

Prep.—Acetum Cantharidis, Acidum Acet. dil., Acetas Potassæ, Oxymel, Extractum Colchici Aceticum, Liquor Morphiæ Acetatis.

ACIDUM ACETICUM DILUTUM.

Ingredients :

23 drachms of Acetic Acid to a pint of water.

It is ordered to be made by adding sufficient of the water to the acid to accurately fill a pint measure.

Qualities.—Sp. gr. is 1·008: a fluid ounce of it is saturated by 57 grains of the crystals of carbonate of soda. Thus its strength is about the same as that of distilled vinegar, but being more pure, it is now employed in many pharmaceutical preparations.

Preparations.—Acetum Colchici, Acetum Scillæ, Emplastrum Ammoniaci, Liq. Amm. Acet., Ung. Plumbi Comp.

ACETUM CANTHARIDIS.

This is a very useful preparation for producing speedy vesication: a piece of linen moistened with it is a convenient mode of applying it; or it may be applied by a camel's hair brush. It will often produce a blister in half an hour. It is not intended for internal administration.

ACETUM COLCHICI.

The proportion of the dried cormus to the liquid is three drachms and a half to one pint of dilute acetic acid and one ounce and a half of proof spirit. According to some German chemists, the alkaline principle is not veratria, but a distinct substance, which they name Colchicia; therefore we have the acetate of colchicia in solution. This vegetable alkali is best procured from the seeds of colchicum.

Medical Properties.—Diuretic, purgative, diaphoretic, and sedative; most used in gout and rheumatism. It does not agree with the stomach so well as the vinum colchici.

Dose.—ʒss to ʒij.

ACIDUM HYDROCHLORICUM DILUTUM.

This is made by mixing five ounces of the strong acid with fifteen ounces of distilled water.

Qualities.—Its sp. gr. is 1·043. A fluid ounce of this acid is saturated by 168 grains of the crystals of carbonate of soda.

Hydrochloric acid was ordered to be obtained in the former Pharmacopœia by the following process:

HYDROCHLORIC ACID.

Ingredients:

Chloride of Sodium,
Sulphuric Acid,
Distilled Water.

Decomposition.—When the chloride of sodium, the acid, and half the water, are heated together, some water and the chloride are decomposed, the oxygen of the water, combining with the sodium, forms soda; this, with the sulphuric acid, forms sulphate of soda; the hydrogen, combining with the chlorine, forms hydrochloric acid gas, which passes over into the receiver, where it is absorbed by the water placed there for that purpose; super-sulphate of soda remains in the retort.

This liquid is a solution of hydrochloric acid gas in water; water can absorb 480 times its volume of this gas.

Composition of this acid:

1 chlorine = 36
1 hydrogen = 1
Atomic number . 37

Formula $H\,Cl$.

Medical Properties.—Tonic and antiseptic. It is given with benefit in typhoid fevers and scarlatina; in the treatment of worms, and in cases of abundance of the earthy phosphates in the urine. It has been erroneously supposed to be a solvent for all urinary calculi; although it may not be able to dissolve calculi in the bladder, through the medium of the circulation, still it has the power of arresting their rapid increase. It is also very useful as a gargle, when considerably diluted, in putrid sore throats.

Dose.—♏x to ♏xxx of the dilute acid.

Preparations.—Ferri Ammonio-Chloridum, Tinctura Ferri Sesquichl., Liq. Arsenici Chl., Zinci Chloridum.

ACIDUM HYDROCYANICUM DILUTUM.

Ingredients :

Ferrocyanide of Potassium.
Sulphuric Acid.
Distilled Water.

Decomposition.—In this process 2 equivalents of the ferrocyanide of potassium, 6 equivalents of sulphuric acid, and 3 equivalents of water, are engaged; the water is decomposed; its oxygen combining with potassium forms potash, which the sulphuric acid immediately seizes upon, forming bisulphate of potash; the 3 hydrogen, uniting with 3 cyanogen, form 3 hydrocyanic acid, which, by the heat, pass over into the receiver; and besides the 3 bisulphate of potash, we have remaining, in the retort, a salt, consisting of 1 equivalent of cyanide of potassium and 2 of cyanide of iron.

This acid is ordered to be kept from the light, in consequence of readily undergoing decomposition. From being colourless, it turns somewhat brown, and affords subsequently a blackish deposit, a compound of carbon, hydrogen, and nitrogen; and we sometimes find ammonia in the water.

In another formula, in which hydrochloric acid and cyanide of silver are employed, there is mutual decomposition; the chlorine goes over to the silver, and the hydrogen to the cyanogen, forming hydrocyanic acid, which is held in solution, and subsequently poured off from the precipitated chloride of silver.

The tests for its purity are these: It is colourless, and entirely vaporizable by heat, with a peculiar odour. It slightly reddens litmus paper, and, being volatile, the red colour so produced soon disappears. It is not coloured by hydrosulphuric acid. 100 grains of this acid are accurately saturated by 12·59 grains of nitrate of silver. Some other acid is present if a red precipitate falls, on the addition to it of the iodo-cyanide of potassium and mercury. Two grains of real hydrocyanic acid are contained in 100 grains of this dilute acid.

By its volatility we ascertain the absence of solid matter. Hydrosulphuric acid not discolouring it shows the absence of metallic salts. By the nitrate of silver its strength is ascertained; and the cyanide being soluble in nitric acid shows that no hydrochloric acid was present. If any other acid be present when the iodo-cyanide of potassium and mercury is added, there will be a red precipitate of biniodide of mercury.

Composition of the anhydrous acid:

1 hydrogen = 1
1 cyanogen = 26

Atomic number . . 27

Formula Cy H, or $C^2 N H$.

Medical Properties.—Powerfully sedative. It diminishes the heart's action, and also that of vessels in parts which it can readily be applied to. It checks vomiting in irritation or in sub-acute inflammation of the stomach; is useful in dyspepsia, depending on the preceding causes. It is given in asthma, hooping-cough, phthisis, and in coughs generally; it has been applied successfully to the surface of the body, in the treatment of some skin diseases.

Dose.—5 minims, carefully increased.

ACIDUM NITRICUM DILUTUM.

Dilute nitric acid is ordered to be made with 3 fluid ounces of nitric acid, 17 fluid ounces of water. Its specific weight is 1·082. A fluid ounce of this acid is saturated by 154 grains of the crystals of carbonate of soda.

Strong nitric acid is prepared usually by the following process:

ACIDUM NITRICUM. (Ph. Lond., 1836.)

Ingredients:

Nitrate of Potash,
Sulphuric Acid.

Decomposition.—The sulphuric acid combines with the potash, forming bisulphate of potash, and the disengaged nitric acid is driven by the heat into the receiver.

The acid is used in excess, in order to supply a sufficient quantity of water to form liquid nitric acid, and to prevent the disengagement of nitrous acid. Should any nitrous acid be present, it can readily be expelled by heat. It is also more convenient to the manufacturer to obtain bisulphate of potash, as it is more soluble than the sulphate and more easily removed from the retort.

Composition :

5	oxygen 5 × 8 =	40
1	nitrogen	14
1½	water	13·5
		67·5

Formula NO^5, HO.

Nitric acid of specific gravity 1·420 is considered to contain 4 atoms of water.

Formula $NO^5, 4\,HO$.

Medical Properties.—Tonic and antiseptic. It has been much used, largely diluted, as a drink in typhoid fevers; in which, like most other acids, it acts by its sedative or antiphlogistic properties; and, by restoring the circulation to its proper standard, becomes also tonic. It has been much and successfully employed in syphilis, when mercury was inadmissible. It is applied externally to fetid ulcers, in the quantity of 15 minims to a pint of water; and has been given internally in calculous affections, where the phosphates are predominant.

Its vapour has been used to prevent or destroy contagion: hence it is often employed in purifying gaols, hospitals, ships, &c. This is done by pouring sulphuric acid on nitrate of potash.

Nitric acid is also used occasionally as an escharotic. Dropped into a hollow tooth, it is often efficacious in arresting toothache.

Dose of dilute nitric acid ♏x to ♏xx.

ACIDUM PHOSPHORICUM DILUTUM.

Ingredients :

Phosphorus,
Nitric Acid,
Distilled Water.

Five atoms of nitric acid are now considered to be decomposed by 3 atoms of phosphorus, each of which takes 5 equivalents of oxygen; and thus we have formed 3 equivalents of phosphoric acid, and 5 equivalents of binoxide of nitrogen are disengaged, which, with oxygen of the air, form nitrous acid fumes. The phosphoric acid remains with the water.

Composition of phosphoric acid.

5 oxygen	5 × 8 =	40
1 phosphorus		32
		72

Tests of its Purity.—If chloride of barium and nitrate of silver produce precipitates insoluble in nitric acid, it is evident from the first that sulphuric acid is present; from the second hydrochloric—the precipitates being sulphate of baryta and chloride of silver. Plates of copper or silver, if acted on, would indicate the presence of nitric acid, and hydro-sulphuric would produce a precipitate, if metallic salts were in the acid liquid. The sp. gr. of this liquid is 1·064, and 132 grains of the crystals of carbonate of soda saturate 1 ounce of this acid, without any precipitation, which shows that no phosphate insoluble in water was held in solution by excess of acid.

Medical Properties.—It is said to be tonic in some dyspeptic cases, and very serviceable in cases of exostosis, on which this acid is supposed to act chemically, that is, rendering the phosphate of lime soluble, and thereby diminishing it, if disposed to accumulate. It is also occasionally prescribed in urinary affections, especially the phosphatic diathesis; and has been recommended to allay thirst in fevers.

Dose.—♏ xx to ʒj.

ACIDUM SULPHURICUM DILUTUM.

Dilute sulphuric acid is now ordered to be made by adding to fifteen fluid drachms of sulphuric acid, as much water as will accurately fill a pint measure. Its specific gravity is 1·103; a fluid ounce of this acid is saturated by 216 grains of the crystals of carbonate of soda.

The acid should be gradually added to the water, in order to obviate the powerful extrication of heat which would result from adding a little water to the acid, and by which the vessel used is often broken; the cause of the heat evolved, is condensation of the liquids. There are many theories and processes concerning the mode of obtaining sulphuric acid, and considerable secrecy is observed by the manufacturers.

The plan now adopted for obtaining sulphuric acid is said to be this. Three separate chambers are employed, which communicate with a larger central one lined with lead. In one chamber sulphur is burned to form sulphurous acid; in the second, nitric acid fumes are disengaged by acting upon nitrate of potash with sulphuric acid, and in the third steam is generated. When these three products enter the central chamber, 3 equivalents of sulphurous acid abstract 3 equivalents of oxygen from one of nitric acid to form 3 equivalents of sulphuric acid, which uniting with the steam, form liquid sulphuric acid, and binoxide of nitrogen rises in the chamber, and uniting with 2 equivalents of oxygen and becomes nitrous acid. This descending, is attacked by 2 equivalents of sulphurous acid, and gives up two of oxygen, and thereby produces 2 of sulphuric acid, and again rises, as binoxide of nitrogen, to be a conveyer of oxygen to the sulphurous acid, which continues to enter the chamber. During this time, steam is constantly entering the chamber, and by condensation holds the sulphuric acid in solution at the bottom of the chamber, from which it is drawn off by stopcocks, and its strength is ascertained.

Sulphuric acid, with only half an equivalent of water, is obtained by distillation from the sulphate of iron, and is called *Nordhausen* sulphuric acid, or dihydrated sulphuric acid; and from this, anhydrous sulphuric acid may be procured in a solid crystalline form.

Sulphuric acid is seldom quite pure; it generally contains a small quantity of sulphate of lead, and often a trace of arsenic, the former of which is often seen in the form of a white flocculent precipitate, when the acid is diluted with water.

By mixing four parts of sulphuric acid with one of water, such condensation of volume takes place as to evolve heat of the temperature of 300 degrees.

Composition of the anhydrous acid:

3 oxygen	$3 \times 8 =$	24
1 sulphur		16
		40
The liquid acid contains—		
1 water	$=$	9
		49

Formula SO^3, HO.

Medical Properties.—Tonic, refrigerant, and antiseptic. This acid is frequently given to check the night sweats in phthisis, and as a tonic with vegetable bitters after fevers, and especially with the sulphate of quinine and other preparations of cinchona. It is useful in most hæmorrhages, acting as an astringent and sedative; and has been added to ointments, to make a stimulating application.

Dose.—Of the diluted acid, from 10 to 30 minims.

ACIDUM TARTARICUM. (Ph. Lond., 1836.)

Ingredients:

Bitartrate of Potash,
Boiling Water,
Prepared Chalk,
Dilute Sulphuric Acid,
Hydrochloric Acid.

Decomposition.—In obtaining this acid, there are four distinct stages of chemical action and decomposition:

1. When the bitartrate and half the chalk are boiled in water, they are both decomposed, the bitartrate surrendering one equivalent of its acid to the lime, forming a tartrate of lime, which falls to the bottom, carbonic acid escapes, and a tartrate of potash remains in solution. The solution of tartrate of potash, instead of being rejected, is reserved to yield its tartaric acid also.

2. The hydrochloric acid is added to the rest of the chalk ordered, when decomposition ensues; the chlorine with the calcium forms a chloride of calcium in solution, the hydrogen of the acid and oxygen of the lime form water, and carbonic acid is evolved.

3. When we add the solution of chloride of calcium to the solution of tartrate of potash, fresh chemical changes occur; the chloride of calcium and tartrate of potash decompose each other; the chlorine with potassium forms a chloride of potassium, the oxygen of the potash passes to the calcium, with which the tartaric acid combines, forming tartrate of lime. In this way the tartaric acid is all transferred from the potash to the lime.

4. When sulphuric acid is added to the washed tartrate of lime, sulphate of lime is formed, and tartaric acid is set free, and, by evaporation, is procured in crystals.

Composition:

4 carbon	$4 \times 6 = 24$	
5 oxygen	$5 \times 8 = 40$	
2 hydrogen	$2 \times 1 = 2$	
Atomic number . . .		66

The crystallized acid contains one equivalent of water. Atomic number, 75.

Formula of the Crystallised Acid, $C^4 O^5 H^2, HO$.

But as this acid is bibasic, most chemists now double its atomic number and thus represent it $C^8 H^4 O^{10}, 2 HO$.

Medical Properties.—Refrigerant, and, with alkalies in the form of neutral salts, mildly purgative. It is much employed as an ingredient in soda powders, to combine with the soda, and disengage carbonic acid; it is also a constituent of Seidlitz powders. Its saturating power is nearly the same as of citric acid.

Dose.—℈j to ʒss.

ETHEREAL PREPARATIONS.

CHLOROFORMYL—CHLOROFORM.

Ingredients:

- Chlorinated Lime,
- Rectified Spirit,
- Water,
- Chloride of Calcium.

Decomposition.—The chemical changes in this process are very complex and doubtful. It is considered by some chemists, that 2 equivalents of alcohol act upon 8 equivalents of hypochlorite of lime, and yield 1 equivalent of chloral, 2 atoms formiate of lime, 5 atoms chloride of calcium, 9 atoms water, and 1 of lime. Secondly, the chloral, 1 of water and lime, act on each other, producing 1 equivalent of terchloride of formyle, and 1 equivalent of formiate of lime; and, lastly, the 3 atoms of formiate of lime, with 3 of hypochlorite of lime, and free lime in excess, are resolved into 6 atoms of carbonate of lime, and these combining with the 5 equivalents of chloride of calcium, are left behind in the retort as a sandy powder.

The above complex description is given, and clearly demonstrated by diagrams, in Mr. Phillips's 'Translation of the Pharmacopœia,' to which the reader is referred.

Composition of chloroform :

2 carbon	6 × 2 =	12
1 hydrogen	=	1
3 chlorine	36 × 3 =	108
		121

Formula $C^2 H Cl^3$

Qualities.—It is free from colour, with an agreeable odour. Its specific gravity is not less than 1·480. It is scarcely at all dissolved in water. It does not stain litmus with a red colour. Rubbed on the skin, it soon passes off, almost no odour being left behind.

Medical Properties.—This liquid is chiefly used as an anæsthetic agent in the performance of operations, and is superior to all hitherto discovered. It reduces muscular contractility, and has, when inhaled, been found very useful in the reduction of dislocations, and in some herniæ. A solution of camphor in chloroform is an admirable remedy for toothache, topically applied. It has been used in tetanus, but with no permanent good result; and in many other cases, such as cholera, &c. But time is still required to establish its character as a safe and certain remedy in many internal diseases.

Dose.—For inhalation, from ʒj to ʒiv. Internally administered, ♏x to ♏xx.

ÆTHER SULPHURICUS. (Ph. Lond., 1836.)

Ingredients :

Rectified Spirit,
Sulphuric Acid,
Carb. of Potash, previously burnt.

Decomposition.—The explanation of the formation of æther by Liebig is as follows: Two equivalents of sulphuric acid act upon one of alcohol, and yield three equivalents of water, and one of the bisulphate of the oxide of ethule: by continuing the heat, the latter bisulphate is decomposed and resolved into one equivalent of ether and two of sulphuric acid.

Alcohol is a hydrated oxide of ethule.

	carb.	*hyd.*	*oxy.*	
Ethule is composed of	4	5		= 29
Æther . . .	4	5	1	= 37
Alcohol . . .	4	6	2	= 46

The carbonate of potash is employed to absorb the water, and prevent its passing over with the æther.

Medical Properties.—A diffusible stimulant and antispasmodic. It is often prescribed in low states of the system with benefit; it is useful in hysteria and asthma; and, during the passage of biliary calculi, has been supposed not only to diminish pain, but likely to act as a solvent to the concretion. By its evaporation, considerable cold is produced; therefore, it is often introduced into cooling external applications.

Dose.—ʒss to ʒjss.

OLEUM ÆTHEREUM.

Ingredients:

Rectified Spirit,
Sulphuric Acid,
Solution of Potash,
Distilled Water.

Decomposition.—The excess of acid in this preparation prevents the formation of æther only, the products being some æther, an oily liquid, sulphurous acid and water; by exposing the supernatant liquid to the air for a day, the æther passes off in vapour, leaving the oily liquid behind; this is to be treated with solution of potash and water, to remove any sulphurous acid, and the residue is named æthereal oil, or oil of wine.

Æthereal oil, or oil of wine, contains the elements of sulphuric acid, in combination with carbon, hydrogen, and oxygen; it is supposed to be a compound of neutral sulphate of æther with the sulphate of a hydro-carbon isomeric with olefiant gas, to which the name etherole is given;

$$C_4H_5O\,SO_3 + C_4H_4SO_3$$

Brande and Turner consider this liquid to be a compound of—

1 sulphuric acid = 40
1 æther = 37

Atomic number . 77

The acid is so intimately combined with the æther, that it affords no precipitate with chloride of barium, unless heat be applied to decompose the oil.

Qualities.—The specific gravity is 1·050. Dropped into water, it sinks immediately in a globular form. It is dissolved in æther; and does not change the colour of litmus.

Medical Properties.—The same as those of sulphuric æther: it is not given alone, but in the form of the spiritus ætheris sulphurici compositus.

SPIRITUS ÆTHERIS NITRICI.

Ingredients:

Nitric Acid,
Rectified Spirit.

Decomposition.—The nitric acid and part of the alcohol are decomposed. The acid is resolved into hyponitrous acid and oxygen, and the alcohol is converted into æther; the oxygen of the acid combining with the disengaged elements of the alcohol, forming water, oxalic, formic, and acetic acids. The nitric æther which is distilled over, may be considered to be a hyponitrite of æther, with uncombined alcohol.

If the specific gravity exceeds ·834, it is probable that nitric acid or water in excess is present. The litmus being strongly reddened, proves an abundance of acid, as also the effervescence occasioned by the carbonate of soda.

Composition:

1 hyponitrous acid = 38
1 æther = 37

Atomic number 75

Formula $C^4 H^5 O, NO^3$

Medical Properties.—Diffusible stimulant, and diuretic.

Dose.—ʒss to ʒij.

SPIRITUS ÆTHERIS SULPHURICI COMPOSITUS.

A mixture of sulphuric æther, rectified spirit, and æthereal oil.

The advantage of this preparation is, that it is miscible with water, and therefore more convenient for internal administration.

Dose.—ʒss to ʒij.

ALKALINA.

ALKALINE PREPARATIONS.

AMMONIÆ SESQUICARBONAS. (Ph. Lond., 1836.)

Ingredients :

Hydrochlorate of Ammonia,
Chalk.

Decomposition.—When heated together, the hydrochloric acid and lime of the chalk are decomposed; the chlorine of the acid combines with the calcium, forming chloride of calcium, the hydrogen of the acid, with the oxygen of the lime, forming water, which rises with the carbonic acid and ammonia, forming hydrated sesquicarbonate of ammonia, chloride of calcium remaining in the retort.

Composition :

3 carbonic acid,
2 ammonia,
2 water.

Formula $2NH^3, 3CO^2, 2HO$

If this preparation could be made in vessels perfectly closed, the ammonia would be in the state of a carbonate instead of a sesquicarbonate; during the sublimation, some water escapes, as also ammonia, which accounts for the preponderance of carbonic acid.

Ammonia combines with carbonic acid in at least three proportions, viz., the monocarbonate, sesquicarbonate, and bicarbonate. The first exists in spiritus ammoniæ aromaticus; the second in the preparation under notice, and this sesquicarbonate becomes bicarbonate by being kept and somewhat exposed to the air, which occasions the escape of some more ammonia.

Medical Properties.—A diffusible stimulant, antispasmodic, antacid, and somewhat diaphoretic; in large doses emetic. As an emetic it may be of great benefit in narcotic poisoning. This substance is often very serviceable in depressed states of the system, as in typhus, confluent smallpox, &c. &c. It is a stimulant and rubefacient, if applied externally

Dose.—As a stimulant, gr. v to gr. x.
As an emetic, gr. xx to gr. xxx.

Prep.—Liq. Amm. Sesquicarb.—Liq. Amm. Acet.—Cupri Ammonio-sulphas.

LIQUOR AMMONIÆ. (Ph. Lond., 1836.)

Ingredients:

Hydrochlorate of Ammonia,
Lime,
Water.

Decomposition.—When the above ingredients are properly mixed and heated, the hydrochloric acid and lime are both decomposed; the chlorine combining with the calcium, forms chloride of calcium; the hydrogen and oxygen form water; by heat the ammonia, which is set free, passes over with part of the water into the receiver.

Liquor Ammoniæ is a solution of ammoniacal gas in water.

Ammoniacal gas is composed of

3 hydrogen $3 \times 1 =$	3
1 nitrogen	14
Atomic number	17

Formula NH^3

Medical Properties.—The same as of the former preparation, and in addition powerfully escharotic. It is not so much given internally. Externally it is often prescribed as a rubefacient, in the form of embrocations. If, accidentally, too large a dose has been swallowed, the best antidote would be some fixed oil, as almond or olive oil. The acids recommended by some would be too irritating, would be swallowed with difficulty, and would form compounds more injurious than the compound formed with the oil.

Dose.—♏ v to ♏ x in milk, or some copious bland liquid.

Prep.—Lin. Ammoniæ.—Lin. Camph. C.—Lin. Hydrargyri.—Tinct. Amm. Comp.

LIQUOR AMMONIÆ ACETATIS.

Ingredients :

Distilled Vinegar,
Sesquicarbonate of Ammonia.

Decomposition.—The acetic acid, by its greater affinity, combines with ammonia, displacing the carbonic acid, which escapes with effervescence. When pure, this liquid affords no precipitate with hydrosulphuric acid, proving the absence of metallic salts: chloride of barium and nitrate of silver producing no precipitate, show that neither sulphuric nor hydrochloric acid is present.

Medical Properties.—Diaphoretic, refrigerant, and somewhat diuretic. It is much used as a cooling application externally.

Dose.—ʒij to ʒvj.

LIQUOR AMMONIÆ CITRATIS.

Ingredients :

Citric Acid,
Distilled Water,
Sesquicarbonate of Ammonia.

Decomposition.—The citric acid combines with the ammonia and expels the carbonic acid.

Formula $3N\,H^3, C^{12}\,H^5\,O^{11}$

Medical Properties.—Refrigerant and antiphlogistic, forming an agreeable medicine in the treatment of fevers.

Dose.—ʒj to ℥ss.

ATROPIÆ SULPHAS.

Ingredients :

Dilute Sulphuric Acid,
Atropia,
Distilled Water.

Chemical Action.—By mixing the above ingredients a soluble sulphate of atrophia is formed, which, by evaporation, may be obtained in crystals.

Atropia is an alkaloid, the active principle of atropa belladonna. It is procurable from the leaves and root of the plant by a process analogous to those usually employed for separating the alkaloids from plants, viz., by treating the plant with spirit and water, adding lime, afterwards dilute sulphuric acid, and finally precipitating by means of carbonate of potash. It is highly poisonous, and is only employed to make the salts of atropia.

Formula $C^{34}H^{23}NO^{6}$. Equiv. 289.

Medical Properties.—This salt is only intended for external use, and especially as an application to the eye to produce dilatation of the pupil. One grain may be dissolved in a drachm of water, and a drop or two of this solution should be dropped between the eyelids.

LIQUOR MORPHIÆ ACETATIS.

Ingredients :

- Acetate of Morphia,
- Acetic Acid,
- Distilled Water,
- Proof Spirit.

Chemical Action.—The acetic acid combines directly with the morphia, forming a salt held in solution by the water and proof spirit.

One drachm of this solution contains a grain of acetate of morphia.

LIQUOR MORPHIÆ HYDROCHLORATIS.

In this, the salt is merely held in solution by the water and spirit. It contains one grain in a drachm, and like the former solution is of nearly the same strength as tincture of opium.

Dose.—♏x to ℥ss.

MORPHIA. (Ph. Lond., 1836.)

Ingredients :

- Hydrochlorate of Morphia,
- Solution of Ammonia,
- Distilled Water.

Decomposition.—The hydrochloric acid combines with the ammonia, forming hydrochlorate of ammonia in solution, and the morphia is precipitated.

Morphia is insoluble in cold water, almost insoluble in æther, soluble in 40 parts of cold alcohol, and in 30 parts of boiling alcohol. Liquid potash and soda dissolve it very readily. It is turned red, afterwards yellow, by nitric acid. It forms a blue colour with the tincture of sesquichloride of iron; if chlorine and ammonia be added to its salts, they are rendered brown, which colour disappears if more chlorine be added.

Composition:

35 carbon	35 × 6 =	210
20 hydrogen	20 × 1 =	20
6 oxygen	6 × 8 =	48
1 nitrogen		14
Atomic number .	.	292

Morphia uncombined with an acid is not used medicinally, as it would have no action in the system, unless it met with some acid in the stomach to give it solubility. It is used in the 'Pharmacopœia' to assist in forming the salts above mentioned. It is less liable to spontaneous decomposition than the salts of morphia by long keeping, and from it the salts may be made when desired.

HYDROCHLORAS MORPHIÆ. (Ph. Lond., 1836.)

Ingredients:

Opium,
Crystals of Chloride of Lead,
Animal Charcoal,
Hydrochloric Acid,
Distilled Water,
Solution of Ammonia.

By the maceration, expression, and bruising, the soluble principles of the opium are dissolved, and the solution is then evaporated to the consistence of a syrup. This is to be treated with three pints of water, and then allowed to stand, that the dregs may subside, and the supernatant solution is to be preserved for use. This solution contains meconate of morphia and codeia: when the chloride of lead is added, water is decomposed, its hydrogen uniting with the chlorine forms hydrochloric acid, which unites with the morphia, forming a soluble hydrochlorate of morphia and codeia; the oxygen of the water with the lead forms an oxide, which combines with the meconic acid, and is precipitated. The solution is then evaporated, that part of the hydrochlorate of morphia may be obtained in crystals, which are put on one side for the present. The poured-off solution, containing part of the hydrochlorate of morphia and all the *codeia,* is treated with ammonia, which, by combining with the acid, throws down the morphia, but the codeia is held in solution. The grand object then of the ammonia is to separate the codeia from the morphia.

The precipitated morphia is now to be treated with dilute hydrochloric acid to dissolve it, and to be mixed with the first formed hydrochlorate of morphia just dissolved by water. To the solution charcoal is added to decolorise it, and by filtration and evaporation all the hydrochlorate of morphia is obtained in crystals.

This salt of morphia possesses the same properties as the acetate, and is given in similar doses. It is thought by many to be more certain in its operation, and certainly can be kept for a longer time without any change taking place in it.

Dose.—Gr. ¼ to gr. ss.

QUINÆ DISULPHAS. (Ph. Lond., 1836.)

Ingredients:

Yellow Cinchona Bark,
Sulphuric Acid,
Animal Charcoal,
Hydrated Oxide of Lead,
Solution of Ammonia,
Distilled Water.

Chemical Changes.—By boiling the bark with the water and sulphuric acid, the active principles of the cinchona are dissolved, and we have in solution sulphate of quina, free kinic acid, and colouring matter. When the oxide of lead is added, it attracts the sulphuric acid, and an insoluble sulphate of lead is precipitated, quina with kinic acid remaining in solution; when to the solution ammonia is added, it unites with the kinic acid, and the separated quina is precipitated. This is then to be collected by filtration, and saturated with dilute sulphuric acid, purified by digesting with charcoal, and evaporated that it may pass into crystals.

Composition:

1 sulphuric acid		= 40
2 quina	2 × 162	= 324
8 water	8 × 9	= 72
Atomic number		436

Composition of quina:

20 carbon	20 × 6	= 120
12 hydrogen	12 × 1	= 12
2 oxygen	2 × 8	= 16
1 nitrogen		14
Atomic number . .		162

Formula $C^{20} H^{12} O^{2} N$.

Medical Properties.—It possesses the virtues of cinchona in a concentrated form, and has justly obtained the character of being a most valuable tonic.

The best mode of administering it, is in distilled water, with two or three drops of dilute sulphuric acid.

Dose.—Gr. j to gr. v.

AQUÆ DESTILLATÆ.

Distilled waters are now obtained by introducing into a retort a quantity of vegetable substances, with water, and distilling over only a part of the liquid; or by using the distilled oil, rubbing it with powdered flint, afterwards with water, and then filtering.

Most of the distilled waters are stimulants, and therefore some caution is necessary in prescribing them as vehicles for other substances in the treatment of fevers.

When the fresh herb is employed instead of the dry one, a larger quantity should be used, in consequence of water entering largely into the substance of the fresh plant.

Distilled waters are often imitated by rubbing any distilled oil with carbonate of magnesia, and afterwards with distilled water, and then filtering. Such waters answer almost every useful purpose.

CATAPLASMATA.

CATAPLASMA CARBONIS.

The charcoal poultice will be found to be an agreeable application to foul, sloughing, gangrenous sores, and particularly in cases of gangrena senilis.

CATAPLASMA CONII.

The hemlock poultice is a useful application to scrofulous ulcers; it allays pain and irritation, and is also likely to tranquillise the system generally. It is applied usefully to painful swellings of the breast, and particularly to open cancer.

CATAPLASMA FERMENTI.

The yeast poultice is considered serviceable in cases of fetid, sloughing, gangrenous sores, and is frequently prescribed in mortification of the extremities, resulting from local injury. It is thought by some to do good by the disengagement of carbonic acid.

CATAPLASMA LINI.

Linseed meal poultice is the most common of these applications. It acts most kindly if it is made with the bruised seeds, from which the oil has not been expressed. The ordinary linseed-meal, prepared from the seeds minutely ground after the removal of the oil, and made into poultice, is liable to become very hard and dry, and difficult to be removed, and more irritating.

CATAPLASMA SINAPIS.

Mustard poultice, or a sinapism, is used as a rubefacient, counter-irritant, and stimulating application.

It is often prescribed as a substitute for cantharides, in consequence of a more certain and speedy operation. Great care, however, is necessary in the employment of sinapisms. If they are applied to an emaciated, delicate, and weakly body, and left on too long, they may occasion sloughing; in children they act sufficiently in the course of ten or fifteen minutes, and should be carefully watched, so that, as soon as the skin is reddened, they may be removed. They are much used in apoplexy, applied to the extremities. If put on the dorsum of the foot, calves of the legs, or thighs, from twenty to thirty minutes may be a sufficient time to leave them on. When in contact with the soles of the feet, a longer time is necessary to produce any effect, in consequence of the thickness of the epidermis.

CATAPLASMA SODÆ CHLORINATÆ.

This poultice will be found serviceable in correcting the fetor of sloughing sores, and is still more efficacious than the charcoal, or yeast poultice.

CERATA.

Cerates, so named from wax entering into the composition of them, are unctuous applications of a firmer consistence than ointments. Few of them require any particular notice.

CERATUM CANTHARIDIS.

This is used to keep up a discharge from blistered surfaces. In some habits it will be liable to cause strangury and bloody urine; the savine ointment is a more safe application.

CONFECTIONES.

CONFECTIO AMYGDALÆ.

The ingredients of this confection are now recommended to be beaten separately, and then mixed, and kept in a dry state. If they are thoroughly incorporated and kept, they are liable to become mouldy. This confection, with water, forms a milky liquid, which is a pleasant demulcent in coughs, and a good vehicle for some more powerful remedies.

CONFECTIO AROMATICA.

The ingredients of this confection are now recommended to be powdered, mixed, and kept dry. If prepared with water, after some time, fermentation takes place, destroying its antacid properties. This confection is a warm stimulant, and mildly astringent. It is incompatible with acids.

Dose.—℈j to ℥ss.

CONFECTIO OPII.

This is a stimulating opiate, useful in cases of debility, and the combination of opium with aromatics prevents much of the unpleasant headache so liable to show itself on the following morning, after the use of opium in general.

Thirty grains of this confection contain about one grain of opium.

Dose.—Gr. xv to gr. xxx.

CONFECTIO PIPERIS NIGRI.

This is an imitation of Ward's Paste. It is employed for internal administration in piles; and is very often beneficial in persons of a relaxed and enfeebled habit. It stimulates the intestines, and aids the venous circulation.

Dose.—ʒss to ʒjss.

DECOCTA.

Decoctions are made by boiling substances in water, and the quantity of the liquid is to be reduced, so as to concentrate it. By this process more soluble matter is extracted, but at the same time volatile principles are likely to be dissipated. Vegetables that contain volatile oils as their active ingredient, are not adapted for such preparation.

DECOCTUM ALOES COMPOSITUM.

This is the mildest preparation of aloes. The aloes is modified in its action by the carbonate of potash, which increases its solubility, and appears to form a soapy compound with it. There are nearly four grains of aloes in each ounce of this decoction.

Medical Properties.—It is a tonic, stomachic, and often used as an emmenagogue, and by some as a purgative.

In dyspepsia it may be given in doses of three or four drachms twice a day.

As an emmenagogue, it is frequently ordered with Mist. Ferri Composita, in the proportion of half an ounce to an ounce of the latter mixture.

As a purgative, from 6 drachms to 1½ ounce may be given.

DECOCTUM CHIMAPHILÆ.

This is a diuretic remedy, of a very doubtful action.

Dose.—℥j to ℥ij.

DECOCTUM SCOPARII COMPOSITUM.

This is a diuretic preparation, and may be given in doses of one to two ounces, three times a day, and is an excellent vehicle for other diuretics.

DECOCTUM VERATRI.

This decoction is intended for external use in some skin diseases, and to destroy insects on the surface of the body.

EMPLASTRA.

EMPLASTRUM BELLADONNÆ.

This is a very useful application to allay pain, in dysmenorrhœa, pleurodynia, pains of the joints; and, in coughs, is found to be of considerable service, applied to the chest.

ENEMATA.

ENEMA ALOES.

This is a very useful injection for removing ascarides from the rectum; it may also be employed in other cases in which purgative enemata are recommended.

ENEMA OPII.

The quantity of opium ordered in the 'Pharmacopœia' is presumed to be proper for an injection to allay irritation in the rectum, or contiguous parts, or to tranquillise the system generally.

Medical men are not agreed upon the relative effects of opium introduced into the stomach and per anum. Cases have been given by French writers of persons losing their life by small quantities introduced in the latter method; but still I should consider that twice the quantity might be injected into the rectum that should be given by the stomach, providing that each part is in an equally healthy condition, and has not been habituated to the use of opium.

ENEMA TABACI.

The tobacco enema is a powerful sedative and purgative, requiring considerable care in its use. It is chiefly prescribed in cases of hernia; and is recommended by some in enteritis and peritonitis.

Eight ounces are a sufficient quantity to be injected at once.

ENEMA TEREBINTHINÆ.

This enema is useful in cases of ascarides; in tænia, the liquid would scarcely pass up sufficiently to come in contact with the worm and remove it. It is a good injection in colic, and may be employed in some cases of enteritis and peritonitis.

EXTRACTA.

Extracts are either expressed juices, evaporated to a proper thickness, or made by decoction in water, and the soluble matter evaporated; or by means of spirit, to extract resinous substances.

Of the expressed juices there are six, viz.:

Extr. Aconiti,
Belladonnæ,
Colchici Cormi,
Conii,
Hyoscyami,
Lactucæ.

EXTRACTUM ALOES (PURIFICATUM, Ph. L., 1836).

By the maceration in water, the resinous matter is separated, and we obtain a form of aloes less irritating to the rectum. It is given in rather larger doses than the common extract.

EXTRACTUM COLCHICI.

This extract is procured by pressing the fresh cormus of colchicum, and evaporating the expressed juice to a proper consistence.

Dose.—Gr. j to gr. iij.

EXTRACTUM COLCHICI ACETICUM.

This extract is given in about the same doses as the former, in gout and rheumatism.

EXTRACTUM ELATERII.

This substance is prepared differently from all other extracts, and should rather be called a dried fæcula.

If much pressure be used, the drug will be darker coloured than usual, and less active, in consequence of an increased proportion of mucilaginous matter.

Dose.—Gr. ¼ to gr. ij, cautiously increased.

Several of the extracts are made by macerating the vegetable substance in water, then using decoction, straining, and finally evaporating to a proper consistence.

They are,—

Extr. Gentianæ,
Glycyrrhizæ,
Hæmatoxyli,
Lupuli,
Papaveris,
Pareiræ,
Sarzæ,
Taraxaci,
Uvæ Ursi.

EXTRACTUM JALAPÆ.

This extract is procured in a peculiar manner. The jalap is first digested in spirit, to dissolve the resinous matter, and the tincture is poured off into another vessel. The residue is then to be boiled in water, to dissolve out the gummy ingredients. The decoction and tincture are to be strained separately, the tincture to be distilled, and the decoction evaporated, and the resulting extracts to be mixed together. The distillation in the one case is employed for the sake of economy, viz., to save the spirit. This extract is rather more powerful in its operation than the powder.

EXTRACTUM NUCIS VOMICÆ.

This extract is prepared by first steaming the nut to soften it, then bruising and digesting in rectified spirit for ten days, afterwards filtering and distilling off the spirit, until the extract acquires a proper consistence. This extract must be used cautiously, one fourth of a grain is a sufficient dose to begin with. *Vide* Nux Vomica in Materia Medica.

EXTRACTUM OPII PURIFICATUM.

The ostensible object of this preparation is to procure a more active form of opium; the impurities are removed, but certainly the drug becomes less powerful. It produces rather less unpleasant effects on the head than common opium.

EXTRACTUM PAPAVERIS.

This extract is made from the dry capsules, and used as a substitute for opium. It does not equally confine the bowels, stimulate, or cause distressing headache.

It is very liable to vary in its strength, from too long or insufficient boiling, and is altogether a doubtful remedy.

Dose.—Gr. iv to gr. x. From 8 to 10 grains are usually considered to be equivalent to 1 grain of opium.

EXTRACTUM STRAMONII.

This extract is made from the seeds. It is a powerful anodyne narcotic remedy, and requires to be administered cautiously.

Dose.—Gr. ¼ to gr. ij.

INFUSA.

Infusions are usually made by pouring upon vegetable substances boiling water, and allowing them to stand to cool; then pouring off the clear supernatant liquid, or straining. There are few requiring any particular notice.

INFUSUM CINCHONÆ SPISSATUM.

This inspissated infusion of cinchona is considerably stronger than the common infusion, and will be found very useful in dispensing to economise time. Half a drachm is considered equal in effect to an ounce and a half of infusum cinchonæ.

INFUSUM DIGITALIS.

This is now made in the proportion of one drachm of the dried leaves to 21 ounces of fluid; about half an ounce of it may be considered equal in effect to one grain of the powder.

Dose.—ʒij to ʒvj three times a day.

INFUSUM BUCHU.

This preparation is diuretic, and possibly tonic to the urinary organs.

Dose.—℥j to ℥ij.

INFUSUM KRAMERIÆ.

This infusion is astringent, and slightly tonic.

Dose.—℥i to ℥ij.

INFUSUM LUPULI.

An agreeable formula for the administration of hops. It is tonic, stomachic, anodyne, and soporofic.

Dose.—℥j to ℥ij.

LINIMENTUM ÆRUGINIS.

This preparation is chiefly used as an escharotic and detergent application to unhealthy sores in the throat.

LINIMENTUM HYDRARGYRI COMPOSITUM.

This is a form for applying mercury to the surface, which is in many cases more active than the stronger mercurial ointment. About a drachm of it may be used for each inunction.

MEL BORACIS.

This has long been a favorite remedy in treating the thrush of infants; it is a cooling and detergent application. A small quantity may be introduced into the mouth, three or four times a day.

METALLICA.

Metallic Preparations.

ALUMEN EXSICCATUM.

By heat, the water of the alum is expelled. In its dry state, alum becomes mildly escharotic.

Composition of crystallised alum:

2	sesquioxide of aluminum	26 × 2 =	52
1	potash		48
4	sulphuric acid	40 × 4 =	160
24	water	9 × 24 =	216
			476

Formula $Al^2O^3, 3SO^3; KO, SO^3; 24 HO$.

LIQUOR ALUMINIS COMPOSITUS.

This is simply a solution of alum with sulphate of zinc, without any decomposition.

Medical Properties.—It is used in the form of a collyrium, diluted with six or eight times as much water. It forms a good injection in leucorrhœa and gleet, and is said to be useful in the treatment of chilblains.

ANTIMONII OXYSULPHURETUM.

Ingredients :

Tersulphuret of Antimony,
Solution of Soda,
Distilled Water,
Dilute Sulphuric Acid.

Decomposition.—When the first three are boiled together, three eq. of the soda and one of tersulphuret of antimony decompose each other, forming one eq. teroxide of antimony, and three eq. of sulphuret of sodium, whilst the rest of the tersulphuret is held in solution by the undecomposed soda.

When the acid is added, it unites with the soda, forming a sulphate of soda in solution; and, at the same time, some water is decomposed, the hydrogen of which, with the sulphur of the sulphuret of sodium, forms hydrosulphuric acid gas, and is evolved; and the oxygen of the water unites with the sodium, forming soda, which combines with the sulphuric acid. We have precipitated, teroxide of antimony, with tersulphuret of antimony, which are obtained by filtration.

Qualities.—Golden, red: the whole of it is dissolved in a hot solution of potash, and nearly the whole in hot hydrochloric acid, hydrosulphuric acid being evolved, and a little sulphur being left. These solutions are void of colour (showing the absence of vegetable colouring matters).

This preparation is variable in its composition; according to an analysis of Mr. Phillips, it contains in 100 parts—

Teroxide of Antimony	13·04
Tersulphuret of Antimony	75·36
Water	11·60

Medical Uses.—It is considered to be alterative and diaphoretic, and is recommended in some skin diseases. In larger doses it will sometimes act as an emetic. It is an ingredient in the Pilula Hydrargyri Chloridi Composita.

Dose.—Gr. j to gr. iij.

ANTIMONII POTASSIO-TARTRAS.

Ingredients :

Tersulphuret of Antimony,
Sulphuric Acid,
Bitartrate of Potash,
Distilled Water.

ecomposition. When the tersulphuret of antimony is ed with the sulphuric acid, one equivalent of ter- huret of antimony decomposes three atoms of sulphuric taking from each atom one equivalent of oxygen, and becoming teroxide of antimony, three atoms of iurous gas flying off; and, likewise, the sulphur of ersulphuret ignites and passes off as sulphurous acid then the teroxide of antimony unites with three s of undecomposed sulphuric acid, forming a ter- iate of antimony. Secondly, when the water is added rsulphate of antimony, the latter is converted into a le super-sulphate, and an insoluble sub-sulphate of iony, which, by repeated washing, is converted into nhydrous disulphate of antimony. Thirdly, when isulphate of antimony is boiled in water with two s of bitartrate of potash, two equivalents of tartaric combine with two atoms of the teroxide of antimony, wo atoms of tartrate of potash, remain in solution, and sulphuric acid is set free; by evaporation, crystals of r-emetic are formed, and the supernatant water and iuric acid are poured off.

mposition of the crystals according to Mr. Phillips:

1 tartrate of antimony		219
1 tartrate of potash		114
3 water	9 × 3 =	27
		360

Formula $SbO^3, C^4H^2O^5; KO, C^4H^2O^5; 3HO$.

alities.—Free from colour; is dissolved in water. solution is not altered by ferrocyanide of potassium. osulphuric acid being added, it throws down a red pitate; chloride of barium or nitrate of silver throw- own no precipitate insoluble in nitric acid, show the ice of chlorides or sulphates. By nitric acid, it rs down a precipitate, soluble in excess of the acid. 100 grains of this salt, dissolved in water, hydro- iuric acid precipitates 49 grains of the tersulphuret timony.

dical Properties.—This salt is the most active of the ionial preparations. It is alterative, diaphoretic, tic, expectorant, purgative, and emetic. It is given ally in fevers, in pulmonary inflammations, hooping-cough, croup, and orchitis; it is one of the best emetics at the commencement of the exanthemata and fevers generally, but it is contra-indicated where there is much debility. It is likewise applied to the skin, mixed with lard, in liniments or plasters, to produce a pustular eruption.

Dose.—As an expectorant, gr. ⅛.
a diaphoretic, gr. ¼.
a purgative, gr. ½.
an emetic, gr. j to gr. iij.

The wine of this salt contains two grains in an ounce.

PULVIS ANTIMONII COMPOSITUS.

Ingredients:

Tersulphuret of Antimony,
Horn Shavings.

By exposing these substances to heat, the sulphur of the antimony attracts oxygen from the air, forming sulphurous acid gas, which flies off; the antimony, attracting oxygen, forms an oxide of antimony. The gelatine of the horn is decomposed, and converted into ammonia, carbonic acid, oily matter, and water, leaving behind phosphate of lime. Thus the resulting powder is a mixture of phosphate of lime and an oxide of antimony.

Antimonious acid has no activity as a medicine, like the teroxide. This preparation is very objectionable, on account of the uncertainty of its composition: for when it contains the protoxide, it is active; but when it contains antimonious or antimonic acid, it is inert.

Medical Properties.—Considered by some to be diaphoretic, sedative, and purgative.

Dose.—Gr. ij to gr. vj.

Antimony combines with oxygen in three proportions:

The protoxide, now called the teroxide of antimony, contains	3 oxygen, 1 antimony.
Antimonious acid, sometimes called peroxide of antimony, and antimoniate of antimony	4 oxygen. 1 antimony.
Antimonic acid	5 oxygen, 1 antimony.

PREPARATIONS FROM ARSENIC.

LIQUOR ARSENICI CHLORIDI.

edients :

Arsenious Acid,
Hydrochloric Acid,
Water.

mposition.—When the acid and a little water are together, the arsenious and hydrochloric acids are lecomposed, forming water and chloride of arsenic, is held in solution by the rest of the water; but, ing to some chemists, there is simple solution of cids.

lical Properties.—This solution is used for the same ies, and has the same properties as the Liq. Potassæ tis, but is a weaker preparation. It contains one and a half of arsenious acid in the ounce.

ie.—♏viij to ♏xv.

LIQUOR POTASSÆ ARSENITIS.

edients :

Arsenious Acid,
Carbonate of Potash,
Compound Tincture of Lavender.
Distilled Water.

mposition.—The arsenious acid combines with the forming arsenite of potash in solution, the carbonic ing expelled.

drachms of this solution contain one grain of us acid. It is known by the name of "Fowler's n."

ical Properties.—Tonic and alterative given in neuralgic affections, periodical headaches, and some eases.

.—♏v, gradually increased to ♏xij.

BISMUTHI NITRAS. (Olim Trisnitras.)

dients :

Bismuth,
Nitric Acid,
Distilled Water.

Decomposition.—When the nitric acid and part of the water are mixed, and the bismuth is added to them, one eq. of the nitric acid is decomposed, giving oxygen to the bismuth, whilst binoxide of nitrogen is evolved; the undecomposed three eq. of acid combines with the oxide, forming a ternitrate of bismuth.

When the remaining water is added, the ternitrate is decomposed, the water abstracts two atoms of the nitric acid, and an insoluble nitrate of bismuth is precipitated.

Composition:

1 nitric acid . . .	54
1 oxide of bismuth . .	237
	291

Formula $Bi\,O^3, NO^5$

Qualities.—It is soluble in nitric acid, without effervescence; thus showing that no carbonate is present. If in this solution sulphuric acid causes no precipitate, it proves the absence of lead.

Medical Properties.—Tonic, antispasmodic, and sedative; useful in pyrosis, gastrodynia, and dyspepsia.

Dose.—Gr. v to gr. xv.

CALX.

Lime is procured conveniently from chalk by burning it to expel the carbonic acid; by burning 100 parts of chalk, nearly 56 parts of lime remain, in accordance with the combining proportions exhibited by the atomic theory.

The lime is mentioned on account of being employed in the preparation of Liquor Calcis, Liquor Ammoniæ, Liquor Potassæ, Potassa cum Calce, and Calcii Chloridum.

LIQUOR CALCIS.

This is merely a solution of lime in water. More lime is used than the water can dissolve, and the residual lime is to be put into the bottles, in order that the water may always be saturated. For, in using this liquid, each time the stopper is taken out, some carbonic acid might enter, and combine with some lime, to form an insoluble carbonate, thus gradually diminishing the quantity of lime in the water.

Lime is more soluble in cold than hot water: thus, a pint of water, at three different temperatures, dissolves the following number of grains:

At 32°	13·25
60°	11·6
212°	6·7

Medical Uses.—Antacid, and somewhat astringent. It has been given in dyspepsia, diarrhœa, dysentery, worm cases, and is used externally with linseed oil in the treatment of burns.

Dose.—ʒj to ℥iij.

CUPRI AMMONIO-SULPHAS.

Ingredients:

Sulphate of Copper,
Sesquicarbonate of Ammonia.

Decomposition.—The chemical action of this salt is obscure; but, on the authority of Mr. Phillips, it is much simplified—thus, when the salts are rubbed together, the sulphate of copper decomposes the sesquicarbonate of ammonia, appropriating to itself the ammonia and water, forming a cuprosulphate of ammonia, and setting free carbonic acid. An excess of the sesquicarbonate of ammonia is employed, and, remaining in a free state, gives an ammoniacal odour to the salt.

Composition (supposed):

1 oxide of copper		= 40
2 ammonia	17 × 2	= 34
1 sulphuric acid		= 40
1 water		= 9
		123

Formula $CuO, 2\,NH^3, SO^3, HO$.

Qualities.—Pulverulent, blue; by a brisk fire is converted into oxide of copper; first, the sesquicarbonate, afterwards the sulphate of ammonia, being thrown off. It is dissolved in water. This solution changes the colour of turmeric to brown, and produces a green colour by arsenious acid added to it.

Medical Properties.—Tonic, given in epilepsy and chorea; and is sometimes used externally as an application to the eyes.

Dose.—Gr. ss to gr. iij.

CUPRI SULPHAS.

The commercial sulphate of copper is ordered to be redissolved in water, and crystallized for medical use, to ensure its greater purity.

Qualities.—It is dissolved by water. Whatever ammonia precipitates from this solution, an excess of ammonia again dissolves it (showing the absence of any iron).

Composition:

1	oxide of copper		= 40
1	sulphuric acid		= 40
5	water	9 × 5	= 45
			125

Formula CuO, SO^3, 5 HO.

Medical Properties.—This is the best salt of copper for internal use as an astringent, tonic, and emetic.

Dose.—As tonic and astringent, gr. ss to gr. jss; as an emetic, gr. x to gr. xv.

FERRI SULPHAS.

Ingredients:

Commercial Sulphate of Iron,
Iron Wire,
Sulphuric Acid,
Water.

Decomposition.—The commercial sulphate of iron generally contains some of the sesquisulphate, which it is the object of this process to convert into a protosulphate. When this salt, sulphuric acid, iron, and water are mixed together, and heated, water is decomposed, the oxygen uniting with the metallic iron to form protoxide; and this, with the sulphuric acid, forms protosulphate of iron, and hydrogen is set free. Now, if the sesquisulphate be present, the nascent hydrogen will, in part, unite with the excess of oxygen of the sesquioxide to form water, converting the former into a protoxide, and part of the hydrogen will escape. This protoxide, with the sulphuric acid, also forming protosulphate of iron.

The process would also be beneficial by precipitating any copper.

Composition :

1	sulphuric acid		= 40
1	protoxide of iron		= 36
7	water	7 9	= 63
			139

Formula $FeO, SO^3, 7\ HO$.

Qualities.—When pure it has a blue tinge; after a little time it becomes more green, and, if exposed to the air, will turn of a light brown colour, in consequence of being converted into peroxide of iron. If any sulphate of copper be present, a piece of iron introduced into a solution of it would precipitate copper.

The salts of the protoxide of iron are most active, as medicines.

Medical Uses.—Tonic, emmenagogue, somewhat astringent, and, in large doses, emetic; it is one of the best preparations of iron.

Dose.—Gr. j to gr. v.

FERRI AMMONIO-CHLORIDUM.

Ingredients :

Sesquioxide of Iron,
Hydrochloric Acid,
Hydrochlorate of Ammonia,
Distilled Water.

Decomposition.—The sesquioxide of iron and hydrochloric acid decompose each other; the chlorine combines with the iron, forming a sesquichloride of iron, the oxygen and hydrogen combining to form water; to this the hydrochlorate of ammonia is added. After evaporation, the residue consists of about 15 per cent. of sesquichloride of iron, the rest being hydrochlorate of ammonia, in a state of admixture rather than chemical combination.

Qualities.—It is pulverulent; orange coloured; quite soluble in proof spirit and in water. Each solution gives off ammonia, on the addition of potash; and from 100 grains of it throws down about 7 grains of the sesquioxide of iron.

Medical Properties.—Tonic and emmenagogue, but less frequently prescribed than most of the other preparations of iron.

Dose.—Gr. ij to gr. x.

TINCTURA FERRI SESQUICHLORIDI.

Ingredients:

Sesquioxide of Iron,
Hydrochloric Acid,
Rectified Spirit.

Decomposition.—The chlorine of the acid combines with the iron, forming the sesquichloride; and the hydrogen, with the oxygen, forms water. The sesquichloride is held in solution by the spirit.

Composition:

3 chlorine 36 × 3 = 108
2 iron 28 × 2 = 56

164

The specific gravity of this is ·992. One ounce of this solution throws down about 30 grains of sesquioxide of iron by potash added to it.

Medical Uses.—Tonic, astringent, and externally styptic. It is an excellent remedy in leucorrhœa and gleet, and menorrhagia occurring in delicate habits; for children suffering from prolapsus ani; as a tonic in worm cases; surgeons have found it serviceable in spasmodic stricture of the urethra, and lately it has obtained reputation as an internal remedy in the treatment of erysipelas, given in doses of ʒss every 5 or 6 hours.

Dose.—♏ x to ʒss.

SYRUPUS FERRI IODIDI.

Ingredients:

Iodine,
Iron Wire,
Distilled Water,
Sugar.

In this preparation the iodide of iron, formed as below, is protected from decomposition by the sugar, being a convenient form for its administration. One drachm of the syrup should contain nearly 5 grains of the iodide of iron.

Dose.—♏ xx to ʒj.

FERRI IODIDUM. (Ph. Lond. 1836.)

Ingredients:

Iodine,
Iron Filings,
Distilled Water.

This is a case of simple combination between the iodine and the iron, forming the iodide or ioduret of iron, which is procured in the solid form by expelling the water. It is to be kept away from the air and light, that it may not be decomposed. The iron is apt to be converted into sesquioxide, to prevent which it is recommended to keep a piece of iron wire in it.

Composition:

1 iodine = 126
1 iron = 28
5 water 5 × 9 = 45

Atomic number . 199

Formula $FeI, 5HO$.

Qualities.—By heat it emits vapour of iodine. When pure it is quite soluble in water. If not, sesquioxide of iron will be precipitated. This is also formed when the iodide has been dissolved some time.

Medical Properties.—This remedy combines some of the properties of iodine with those of iron. It is an admirable medicine in some forms of scrofula, in ulcerations of the throat, with atony of system, in general debility, in hysteria, and amenorrhœa. From its stimulating qualities, it is contraindicated in plethora or inflammation.

Dose.—Gr. ij to gr. v.

FERRI CARBONAS CUM SACCHARO.

Ingredients:

Sulphate of Iron,
Carbonate of Soda,
Sugar,
Distilled Water.

Decomposition.—The sulphate and carbonate decompose each other, producing sulphate of soda in solution and carbonate of iron precipitated. The latter is then to be carefully washed; afterwards the sugar, dissolved in two ounces of water, is to be added, and the mixture to be evaporated to dryness by a water bath, but the heat should not exceed 130° Fahr.

This preparation is of a light greenish colour, and contains a carbonate of the protoxide of iron. The sugar is of service in protecting the iron from peroxidation.

Medical Properties.—It may be given in all the diseases for which iron is usually prescribed, and is far more active than the sesquioxide. It may be taken in the form of pill, powder, or electuary.

Dose.—Gr. v to gr. xx.

FERRI AMMONIO-CITRAS.

Ingredients:

Sulphate of Iron,
Carbonate of Soda,
Citric Acid,
Solution of Ammonia,
Distilled Water.

Decomposition.—When the solutions of sulphate of iron and carbonate of soda are mixed together, mutual decomposition ensues, and we have sulphate of soda in solution, and carbonate of iron precipitated. The solution is then poured off, and the carbonate is repeatedly washed to be purified, and afterwards heated with citric acid, which combines with it and forms a citrate of iron. When to the citrate of iron ammonia is added, part of the citric acid unites with the ammonia, and we have the double salt formed of citrate of iron and ammonia; during the exposure to the air and heat, the iron is converted into the sesquioxide.

Qualities.—It is dissolved in water. This solution changes the colour neither of litmus nor of turmeric (showing its neutrality), nor does it become blue by ferrocyanide of potassium added to it; but potash or lime water being added to it, it throws down sesquioxide of iron and gives off ammonia. From 100 grains of it dissolved in water, potash being added to it, about 34 grains of the sesquioxide of iron are precipitated.

Medical Properties.—This preparation of iron may be prescribed for the usual purposes of iron, and will suit many delicate stomachs when other preparations disagree.

Dose.—Gr. iij to gr. x.

FERRI POTASSIO-TARTRAS.

Ingredients:

Sulphate of Iron,
Sulphuric Acid,
Nitric Acid,
Solution of Ammonia,
Bitartrate of Potash,
Distilled Water.

Decomposition.—When the sulphate of iron is dissolved in water together with the sulphuric acid and nitric acid, the latter is decomposed, giving 3 equivalents of oxygen to 6 equivalents of protoxide of iron to form 6 equivalents of sesquioxide of iron, which with 9 equivalents of sulphuric acid form 6 equivalents of sesquisulphate of iron, binoxide of nitrogen flying off: next when the ammonia is added to the sesquisulphate, 9 equivalents of sulphate of ammonia are formed in solution, and 6 equivalents of sesquioxide of iron are precipitated, which are to be repeatedly washed and set by: thirdly, when the moist sesquioxide is added to the solution of bitartrate of potash, part of the tartaric acid combines with and dissolves the oxide of iron, and by evaporation we obtain 6 equivalents of the double salt of tartrate of iron and tartrate of potash.

Qualities.—It is entirely soluble in water, does not change the colour of litmus or turmeric; is not, like other salts of sesquioxide of iron, rendered blue by ferrocyanide of potassium; neither does any alkali produce a precipitate; but, if it be heated with potash, from 100 grains it throws down about 34 grains of the sesquioxide of iron.

Medical Properties.—It is tonic and emmenagogue, and has less unpleasant taste than most other preparations of iron.

Dose.—Gr. v to gr. xx.

FERRI SESQUIOXYDUM.

Ingredients:

Sulphate of Iron,
Carbonate of Soda,
Boiling Water.

Decomposition.—The sulphuric acid combines with the soda, forming sulphate of soda in solution; the carbonic acid unites with the oxide of iron, forming carbonate of iron. During the application of heat and exposure to the air, the iron attracts more oxygen, becoming sesquioxide, and most of the carbonic acid is expelled.

Qualities.—It is soluble in hydrochloric acid, with a little effervescence, showing the presence of some carbonic acid, and should be entirely precipitated from this solution by potash. Then the strained solution is free from colour, and is not coloured by hydrosulphuric acid or ferrocyanide of potassium (showing the absence of copper or other metals).

Medical Properties.—Tonic and emmenagogue, given in chlorosis, amenorrhœa, chorea, tic-douloureux, and is a very good medicine for children in worm cases.

Dose.—℈j to ʒij.

VINUM FERRI.

Ingredients:

Iron Wire,
Sherry.

This preparation of iron, restored to the pharmacopœia, may be considered to be a weak solution of tartrate of iron, with possibly a little acetate. It may be given in doses, of from ʒij to ℥vj.

PRÆPARATA EX HYDRARGYRO.

HYDRARGYRUM CUM CRETA.

Ingredients:

Mercury,
Chalk.

By rubbing them together, the mercury is minutely divided, and mechanically mixed with the chalk. By long trituration, a portion of the mercury may become oxidized.

Qualities.—By heat the mercury is driven off in vapour, and what remains corresponds with the experiments applied to prepared chalk.

Medical Properties.—Mild alterative, most fitted for diseases of children.

Dose.—Gr. v to gr. xx, but for children from gr. j to gr. v.

HYDRARGYRI NITRICO-OXYDUM.

Ingredients:

Mercury,
Nitric Acid,
Distilled Water.

Decomposition.—A portion of the nitric acid is decomposed, giving oxygen to the mercury to form binoxide of mercury, binoxide of nitrogen flying off, and with oxygen of the air forming nitrous acid fumes; the undecomposed acid then unites with the binoxide of mercury, forming pernitrate of mercury, which by evaporation is obtained as a white salt.

When this pernitrate is heated, the nitric acid is expelled, leaving binoxide of mercury with sometimes a small quantity of nitrate.

Qualities.—It consists of shining crystalline scales; by heat is sublimed, and gives off no nitrous vapours. It is dissolved both in nitric and hydrochloric acids.

Medical Properties.—It is not given internally, being too irritating: it is employed externally as an escharotic, and in ointments as a stimulating application.

HYDRARGYRI AMMONIO-CHLORIDUM.

Ingredients:

Bichloride of Mercury,
Solution of Ammonia,
Distilled Water.

Decomposition.—The changes which take place here are not thoroughly agreed upon by chemists. Mr. Hennell considered that white precipitate was a compound of one equivalent of binoxide of mercury, with one of hydrochlorate of ammonia: others contend that it contains no oxygen. Sir R. Kane considers it to be a compound of bichloride and binamide of mercury, its symbol being $Hg\,Cl^2, Hg\,2\,N\,H^2$. Some German chemists have minutely studied this compound, and Mitscherlich has come to the conclusion that it is composed as follows:

1 bichloride of mercury and ammonia = 289
1 chloride of mercury and ammonia = 253
1 nitruret of mercury . . . = 214

Equivalent . . . 756

Formula $Hg\,Cl^2, NH^3; Hg\,Cl, NH^3; Hg\,N$.

In order better to understand the process, the reader is requested to refer to Mr. Phillips's 'Translation of the Pharmacopœia.'

Qualities.—Pulverulent, white; by heat, it entirely passes into vapour. It is entirely soluble in hydrochloric acid, without effervescence (showing the absence of any carbonate). Heated with solution of potash, ammonia is evolved, and it assumes a yellow colour.

Medical Uses.—Chiefly as an external application to destroy vermin about the body, and as an ointment in some skin diseases.

HYDRARGYRI CHLORIDUM.

Ingredients :

Mercury,
Sulphuric Acid,
Chloride of Sodium,
Distilled Water.

Decomposition.—When the acid and half the mercury are boiled together, two equivalents of the acid are decomposed and resolved into sulphurous acid and oxygen; the sulphurous acid flies off in the form of gas, and the two of oxygen with one of mercury form binoxide of mercury, with which two equivalents of undecomposed sulphuric acid combine to form bisulphate of mercury.

When the rest of the mercury is added, it takes away from the bisulphate one equivalent of oxygen and one of acid, thus forming protosulphate of mercury. When the protosulphate is triturated with chloride of sodium, the oxygen quits the mercury to unite with sodium and form soda; this, with the sulphuric acid, forms sulphate of soda; the chlorine unites with the mercury, forming the chloride or calomel, which is separated by sublimation.

Qualities.—It forms a whitish powder, and is turned black by lime-water or potash, in consequence of the formation of protoxide of mercury; and this, by heat, will form globules of mercury. It entirely passes into vapour by heat. As it is insoluble, the water used to wash it should afford no precipitate with nitrate of silver, lime-water, or hydrosulphuric acid; otherwise some bichloride of mercury or other metallic substance is present.

Composition:

1 chlorine = 36
1 mercury = 202

238

Formula $Hg\,Cl$.

Medical Properties.—This is a most valuable preparation of mercury; acting mildly, certainly, and powerfully, according to the dose. It is alterative, stimulant (to the secretions generally), purgative, and antisyphilitic; and is almost an indispensable remedy in inflammation of serous membranes.

Dose.—As an alterative, gr. ¼ to gr. j.
As a purgative, gr. iij to gr. x.

HYDRARGYRI BICHLORIDUM.

Ingredients:

Mercury,
Sulphuric Acid,
Chloride of Sodium,
Water.

Decomposition.—The same chemical action takes place here as in the first stage of the preparation of the chloride, that is, a bisulphate of mercury is formed. When this is dried and mixed with chloride of sodium, and heat is applied, the oxygen of the binoxide of mercury combines with the two of sodium, forming two of soda; these, with the two of sulphuric acid, form two of sulphate of soda; the two of chlorine, with one of mercury, form one equivalent of bichloride of mercury, which is separated from the sulphate of soda by sublimation.

Composition:

2 chlorine $2 \times 36 = 72$
1 mercury = 202

274

Formula $Hg\,Cl^2$.

Qualities.—It is first liquefied by heat, and then passes into vapour. It is entirely soluble in water, rectified spirit, and ether. Potash, lime-water, or soda decomposes it, and throws down a red binoxide of mercury, and, with an excess of either reagent, a yellow hydrated binoxide of mercury, which, by being heated, parts with oxygen, and affords globules of mercury.

Medical Properties.—Generally given as an alterative in secondary syphilis, in skin diseases, and in scrofula; and is used externally in collyria, or washes for other parts.

Dose.—$\frac{1}{16}$ of a grain, gradually increased to $\frac{1}{4}$.

HYDRARGYRI IODIDUM.

Ingredients:

Mercury,
Iodine,
Alcohol.

The mercury and iodine combine directly, and by heat a substance is obtained of a greenish-yellow colour. This is liable to be decomposed by light, which converts it into free iodine and biniodide of mercury.

Composition:

$$\begin{array}{lr} 1 \text{ iodine} & = 126 \\ 1 \text{ mercury} & = 202 \\ \hline & 328 \end{array}$$

Formula $Hg\,I$.

Qualities.—By heat cautiously applied, it can be sublimed in red scales, which, on cooling, turn yellow, and on the admission of light, black. It is not soluble in chloride of sodium, like the biniodide.

Medical Properties.—It is used very successfully in syphilis, and especially when that disease attacks a person of a scrofulous habit of body.

Dose.—Gr. j to gr. iij.

HYDRARGYRI BISULPHURETUM.

Ingredients:

Mercury,
Sulphur.

By heating these together, chemical union takes place; bisulphuret of mercury is formed, and a portion of the sulphur is expelled.

Composition :

2 sulphur $2 \times 16 = 32$
1 mercury $= 202$
234

Formula $Hg\,S^2$.

Qualities.—By heat it passes into vapour, and, if potash be added, it affords globules of mercury, in consequence of the action of the sulphur upon the potash.

Medical Properties.—A mild alterative in skin diseases. Generally employed for fumigation, a practice not very common at the present day.

Dose.—Gr. x to gr. xxx.

PRÆPARATA E MAGNESIO.

MAGNESIA.

This is prepared from the carbonate by the application of heat, by which carbonic acid is evolved.

Composition :

1 oxygen $= 8$
1 magnesium $= 12$
20

Formula $Mg\,O$.

Qualities.—It is soluble in hydrochloric acid, without effervescence, and might be distinguished from the other alkaline earths by its solubility in sulphuric acid. The solution, with hydrochloric acid, produces no precipitate with bicarbonate of potash, or chloride of barium, showing the absence of lime, and any sulphate. It has a feeble alkaline action on turmeric paper.

Medical Properties.—Antacid, and aperient if there be much acid in the intestinal canal. It is preferable to the carbonate, when we wish to avoid flatulence.

Dose.—℈j to ʒj.

MAGNESIÆ CARBONAS.

Ingredients :

Sulphate of Magnesia,
Carbonate of Soda,
Distilled Water.

Decomposition.—There is an exchange of acids between the magnesia and soda, the products being sulphate of soda in solution, and carbonate of magnesia precipitated, which is to be thoroughly washed and dried.

Composition:

1 carbonic acid = 22
1 magnesia = 20
—
42

Formula $Mg\,O, CO^2$.

The medicinal carbonate is considered by some chemists to be a mixture of 4 equivalents of hydrated carbonate of magnesia, with one equivalent of bihydrate of magnesia.

Qualities.—The water in which it may be boiled does not alter the colour of turmeric; there is no precipitate with chloride of barium or nitrate of silver in this liquid, proving the absence of sulphuric or hydrochloric acid. It is soluble in dilute sulphuric acid, 26·6 per cent. of its weight being lost by the escape of carbonic acid. When the effervescence has ceased, there is no precipitate produced by the bicarbonate of potash; any precipitate would indicate impurity.

Medical Properties.—The same as of preceding preparation, and given in about the same doses.

PRÆPARATA E PLUMBO.

PLUMBI ACETAS. (Ph. Lond., 1836.)

Ingredients:

Oxide of Lead,
Acetic Acid,
Distilled Water.

Chemical Changes.—The acetic acid combines with the oxide of lead, and dissolves it; and, by evaporation, the salt is produced in crystals.

Composition:

1 acetic acid = 51
1 oxide of lead = 112
3 water 3 × 9 = 27
—
190

Formula $PbO, C^4\,O^3\,H^3, 3HO$.

alities.—Quite soluble in water. Its solution affords ite precipitate with carbonate of soda, viz., the car-e of lead; with iodide of potassium, a yellow pre-te of iodide of lead falls. By hydrosulphuric acid, huret of lead is thrown down; with sulphuric acid, te insoluble sulphate of lead is formed, and the of acetic acid is made perceptible. By heat it first and ultimately is converted into metallic lead.

dical Properties.—Sedative, astringent, and tonic; prescribed in hæmorrhages, and has been given in œas and dysentery. It is also employed as an in-ı, and as a cooling collyrium and lotion.

e.—Gr. j to gr. iij.

LIQUOR PLUMBI DIACETATIS.

redients:

Acetate of Lead,
Oxide of Lead,
Water.

en the above ingredients are boiled together, the e of lead in solution takes up another atom of lead, ıg a diacetate, that is, a compound of two equivalents de of lead with one of acetic acid.

ıposition of the diacetate:

2 oxide of lead 112 × 2 = 224
1 acetic acid 51
275

Formula $2\,PbO, C^4\,H^3\,O^3$.

s liquid has long been known under the name of lard's Extract."

:cific gravity of the liquid, 1·260. Its tests are the as for acetate of lead.

dical Uses.—It is employed externally as a cooling :ation in inflammations, in the form of a lotion.

PLUMBI IODIDUM.

redients:

Acetate of Lead,
Iodide of Potassium,
Distilled Water.

Decomposition.—Mutual decomposition takes place here. The iodine combines with the lead, forming iodide of lead, which is precipitated; the oxygen, with the potassium, forming potash, which is held in solution by the acetic acid.

Composition :

1 iodine = 126
1 lead = 104
———
230

Formula PbI.

Qualities.—Bright yellow; it is entirely soluble in boiling water, from which it falls, on cooling, in the form of shining yellow scales. It is melted by heat, first giving off yellow, afterwards violet coloured vapours. If sulphate of soda be added to 100 grains of it, dissolved in nitric acid, twice diluted with water at a boiling heat after the iodine has been expelled, 66 grains of sulphate of lead are precipitated. Let the access of light be excluded from it.

Medical Uses.—Iodide of lead acts upon the body like most other preparations of iodine, and in some cases is very powerful. It is employed both internally and externally, for the purpose of reducing glandular tumours.

Dose.—Gr. ¼ to gr. j.

PRÆPARATA E POTASSIO.

LIQUOR POTASSÆ.

Ingredients :

Carbonate of Potash,
Lime,
Distilled Water.

Decomposition.—The carbonic acid combines with the lime, forming carbonate of lime, which is insoluble and remains at the bottom, and the potash set free is held in solution.

This is simply a solution of pure potash in water. It is apt to act upon common flint glass.

Qualities and Tests.—Specific gravity 1·063. In 100 grains 6·7 grains of potash are contained. It has a powerful alkaline reaction, turning turmeric paper brown. Lime water throws down no precipitate, thus showing the absence of carbonic acid; there should be no precipitate from carbonate of soda, chloride of barium, or nitrate of silver (proving the absence of lime, any sulphate, or hydrochlorate); the chloride of platinum occasions a precipitate of a yellow colour with this solution, as well as with the salts of potash, but has no visible effect on soda and its salts; and, therefore, will readily distinguish potash from soda.

Medical Properties.—Antacid, tonic, diuretic, lithontriptic, and externally caustic. It is of service in dyspepsia, skin diseases, in morbid accumulations of uric acid, and in scrofulous affections.

Dose.—♏x to ʒss.

POTASSA CUM CALCE.

Ingredients:

Hydrate of Potash,
Lime.

This is a mechanical mixture of potash and lime.

It is partially soluble in alcohol, the potash only being taken up, and when slaked by water on the addition of an acid gives off no carbonic acid.

It is used as a caustic, and as a substitute for the hydrate of potash, being less deliquescent and more manageable.

POTASSÆ HYDRAS.

Ingredient:

Solution of Potash.

By heat most of the water is driven off, leaving potash combined with one equivalent of water. It was formerly named Potassa Fusa, or "Caustic Potash," and is used solely as an escharotic.

It is entirely soluble in rectified spirit, and speedily deliquesces in an open vessel.

POTASSÆ ACETAS.

Ingredients:

Carbonate of Potash,
Acetic Acid,
Distilled Water.

Decomposition.—The acetic acid combines with the potash, forming the acetate, carbonic acid flying off; the solution is then evaporated till the salt becomes properly dried.

Composition :

1 acetic acid = 51
1 potash = 48
—
99

Formula $KO, C^4 H^3 O^3$.

Qualities and Tests.—It is entirely soluble in water and rectified spirit. This solution has no effect upon test papers (showing its neutrality). The chloride of barium and nitrate of silver causing no precipitate, prove the absence of sulphates or hydrochlorates. If the solution be concentrated, some acetate of silver may fall, which will be soluble in nitric acid; not so, any chloride. By a red heat it is decomposed, and converted into carbonate of potash. Sulphuric acid added to it, occasions an odour of acetic acid, which is set free: from 100 grains of it, when the solution has been evaporated and the salt has been dried by the fire, 88·8 grains of sulphate of potash remain.

Medical Properties.—Diuretic and purgative; seldom prescribed for the latter object.

Dose.—As a diuretic, ʒss to ʒij.
As a purgative, ℥ss to ʒvj.

POTASSÆ BICARBONAS. (Ph. Lond., 1836.)

This salt is made by transmitting carbonic acid through a solution of the carbonate of potash to saturation. This is conveniently effected by Woulfe's apparatus; we conclude that the liquid is saturated by the carbonic acid escaping from the last jar. The solution is then to be evaporated with a gentle heat, as a higher temperature would expel the carbonic acid which has been added.

The carbonic acid is very readily procured by the action of dilute sulphuric acid on powdered chalk.

Composition :

2 carbonic acid 2 × 22 = 44
1 potash = 48
1 water = 9
—
101

Qualities.—It is entirely soluble in water, and very slightly affects the colour of turmeric paper. Sulphate of magnesia causes no precipitate in its solution. By heat, 30·7 parts per cent. of its weight are expelled; chloride of barium should occasion no precipitate in it, and there should be scarcely any by nitrate of silver. If any notable precipitate falls, there is probably a minute portion of chloride of potassium present.

Medical Uses.—It is given for the same purposes, and in the same doses, as the carbonate; and is often preferred on account of its less disagreeable taste. Its saturating power is less, in consequence of containing more acid, and of course a less proportion of base.

POTASSII IODIDUM. (Ph. Lond., 1836.)

Ingredients:

Iodine,
Iron,
Carbonate of Potash,
Distilled Water.

Decomposition.—The chemical action which ensues here is the following:

In the first place there is direct union between the iodine and iron, forming the iodide of iron. When the carbonate of potash is added, the oxygen of the potash combines with the iron, forming oxide of iron, which falls in combination with carbonic acid; the iodine with the potassium, forms a soluble iodide of potassium, which, by evaporation, is procured in crystals.

Composition:

1 iodine = 126
1 potassium = 40

166

Formula KI.

Medical Uses.—This is a very valuable remedy, and is the most available and extensively employed of the salts of iodine. It acts as an alterative, correcting most of the secretions, and has a powerful influence in reducing the size of morbidly enlarged glands. There are many diseases in which it is efficacious, in which there is no definite mode of explaining its operation. It is most serviceable in diseases attacking persons of a scrofulous habit of body.

Dose.—Gr. iij to gr. x, and by some has been extended to ʒj.

LIQUOR POTASSII IODIDI COMPOSITUS.

Ingredients:

Iodide of Potassium,
Iodine,
Distilled Water.

The iodide of potassium renders the iodine soluble, and is usually given with it in solution.

Each ounce of this solution contains half a grain of iodide of potassium and a quarter of a grain of iodine.

Dose.—ʒij to ℥j.

PRÆPARATA E SODIO.

LIQUOR SODÆ.

Ingredients:

Carbonate of Soda,
Lime,
Water.

Decomposition.—The lime used abstracts from the soda its carbonic acid; carbonate of lime is precipitated, and soda is left in solution.

Qualities.—Its specific gravity is 1·061. In 100 grains of it 4 grains of soda are contained. As to its tests they correspond with those of solution of potash, except the last one.

Uses.—It is employed in pharmacy, and may be given medicinally for the same purposes as Liquor Potassæ.

SODÆ CARBONAS. (Ph. Lond., 1836.)

This may be procured from the impure soda, known as kelp and barilla. By solution and straining, most of the impurities are removed; and by evaporation the salt is to be obtained in crystals. From kelp there is a portion of liquid remaining, which contains iodine, and which is known by the term soapmaker's lees, or mother liquors.

Almost all the carbonate of soda in this country is now prepared by evaporating sea water to procure chloride of sodium, which is treated with sulphuric acid to yield sulphate of soda, and this sulphate of soda is mixed with small coal, cinders, sawdust, or other carbonaceous substances, and by burning is converted into carbonate of soda.

Composition:

1	carbonic acid		= 22
1	soda		= 32
10	water	10 × 9	= 90
			144

$NaO, CO^2, 10\,HO.$

Qualities.—Recently prepared, it is translucent, but soon effloresces in an open vessel. It is entirely soluble in water, but not in alcohol. It changes the colour of turmeric, like alkalies.

Medical Uses.—It is antacid, and, combined with acids, forms aperient compounds. It is much prescribed in fevers with some acid, to act as a refrigerant, and, when taken in effervescence, tranquillises the stomach. It is also prescribed in the uric acid diathesis, and in scrofula.

Dose.—Gr. x to ʒss.

SODÆ CARBONAS EXSICCATA.

In this preparation 38 parts per cent. of water are driven off, that it may be administered in the form of powder or pills. The dose is rather less than of the former. 100 grains of it added to dilute sulphuric acid gives off 40·7 grains of carbonic acid.

LIQUOR SODÆ CHLORINATÆ.

Ingredients:

Carbonate of Soda,
Distilled Water,
Chloride of Sodium,
Binoxide of Manganese,
Sulphuric Acid.

In this preparation the carbonate of soda is first dissolved in water; then the chloride of sodium and binoxide of manganese are put into a retort, and sulphuric acid is added to them, for the purpose of setting free some chlorine.

When these three ingredients are mixed, the following decomposition is, by most chemists, supposed to take place: The binoxide of manganese parts with one equivalent of oxygen, which passes to the sodium, to form soda, and set free one equivalent of chlorine; the sulphuric acid combines with the soda and protoxide of manganese, forming sulphates with those bases, and, by heat, chlorine is driven over.

The chlorine is first made to pass through five ounces of water, that any hydrochloric acid which may escape should be absorbed; the gas then passes into the solution of carbonate of soda, with which it combines. The precise chemical nature of this liquid is not ascertained. It is probably a mixture of bicarbonate of soda, chloride of sodium, and hypochlorite of soda.

Formula $Na\,Cl,\ NaO\,ClO,\ 2\,NaO,\ 4\,CO^2$.

This liquid, very similar to Labarraque's soda disinfecting liquid, has a pale straw colour, a sharp saline astringent taste; it first reddens, then bleaches, turmeric paper. It is little affected by heat; by careful evaporation it may be procured in crystals. By spontaneous evaporation, chlorine is evolved, and carbonate of soda alone remains.

Qualities.—The colour of turmeric applied to this solution is first changed to brown, but soon entirely vanishes. Dilute hydrochloric acid being added to it, carbonic acid and chlorine are given off at the same time; the solution of sulphate of indigo is decolorized by it; lime is thrown down from lime-water by it.

Medical Properties and Uses.—It is chiefly employed externally, though occasionally given internally. The cases suited for its external use are gangrenous and ill-conditioned ulcers, carbuncle, cancer, ozœna, gangrene, putrid sore throat. It is in such cases applied, diluted, either in the form of lotion, poultice, or on lint. In cases of salivation, diluted with eight or ten parts of water, it forms a good mouth-wash. Still more diluted, it is injected with advantage in cancer of the uterus. It has also been employed with much benefit in tinea capitis, and some herpetic affections.

Internally it has been given in typhoid fevers, scarlatina maligna, in dysentery with fetid stools, in dyspepsia with fetid eructations, in doses of 15 to 20 minims in an ounce or two of water.

As a disinfecting agent it acts by the chlorine being gradually evolved, which combines with the hydrogen of offensive gases, and thus destroys their fetid odour. It is more expensive than chloride of lime, and is in less extensive use.

PRÆPARATA E ZINCO.

ZINCI CHLORIDUM.

Ingredients:

Hydrochloric Acid,
Zinc,
Distilled Water.

Decomposition.—When the above are heated together, the zinc decomposes the acid, uniting with the chlorine to form chloride of zinc, and hydrogen is set free with effervescence. The solution is then evaporated, and the chloride is obtained in a solid form.

Qualities.—Free from colour; deliquesces in the air; is dissolved in rectified spirit, and in water. From the latter solution a white precipitate is thrown down by hydrosulphuric acid and ferrocyanide of potassium (showing the absence of other matters, as iron, &c.) That which is thrown from the same by ammonia or potash is dissolved by either added in excess (showing the absence of lead or iron). Moreover, that which is thrown down by the carbonate of potash or ammonia is white, but is not dissolved by either added in excess.

Composition:

1	equiv. of zinc	32
1	„ chlorine	36
		68

Formula $ZnCl$.

Medical Properties.—This substance has been used as an escharotic by surgeons; but is not employed for internal use. It is mostly employed in solution as a disinfecting anti-putrescent agent, under the name of 'Burnett's Disinfecting Fluid,' and is found very useful for anatomical preparations, and in preserving bodies for dissection.

ZINCI OXIDUM.

Ingredients:

Sulphate of Zinc,
Sesquicarbonate of Ammonia,
Distilled Water.

Decomposition.—The sulphuric acid, by its greater affinity, combines with the ammonia, forming a soluble sulphate; a portion of carbonic acid, with the oxide of zinc, forms an insoluble carbonate, which is precipitated. When the carbonate is heated, the carbonic acid is evolved, and the oxide remains.

Composition:

1 oxygen = 8
1 zinc = 32

Atomic number . . 40

Formula ZnO.

Qualities.—Pulverulent, yellowish-white; is dissolved by ammonia, potash, or hydrochloric acid.

Medical Uses.—Tonic, not often prescribed for internal use.

Dose.—Gr. j to gr. iij.

It is more used as a tonic and stimulating application to ulcerated surfaces, in the form of the unguentum zinci.

MISTURA FERRI.

Ingredients:

Myrrh,
Carbonate of Potash,
Rose Water,
Sulphate of Iron,
Spirit of Nutmeg,
Sugar.

Decomposition.—The chemical change which occurs here is one of double elective affinity. The sulphuric acid combines with the potash, forming a soluble sulphate of potash, whilst the carbonic acid unites with the iron, forming an insoluble carbonate of iron, which is suspended in the mixture by the myrrh. When carefully prepared, this mixture is at first green, and contains protoxide of iron, more efficacious than the sesquioxide. By keeping, and exposure to the air, the iron passes into a state of sesquioxide, and the mixture changes its colour from green to a dirty brown. There is not more than one grain of oxide of iron in each ounce and a half.

Medical Properties.—Tonic and emmenagogue, most frequently prescribed in chlorosis.

Dose.—℥j to ℥ij.

PILULA FERRI COMPOSITA.

Ingredients:

Myrrh,
Carbonate of Soda,
Sulphate of Iron,
Treacle.

Decomposition.—The sulphate of iron and carbonate of soda decompose each other; the sulphuric acid unites with the soda, forming sulphate of soda, and the carbonic acid with the oxide of iron, forming carbonate of iron. When first prepared, this pill contains the protoxide of iron, and may be useful: but by keeping, it soon becomes sesquioxide, and then is of little service.

Medical Uses.—The same as of the Mistura Ferri Comp.

Dose.—Gr. v to gr. xv.

PILULA HYDRARGYRI.

Ingredients:

Mercury,
Confection of Red Rose,
Liquorice Powder.

In this preparation the mercury is supposed only to be minutely divided, although some entertain an opinion that the mercury is partly protoxidized.

Medical Uses.—It is one of the mildest forms of mercury for internal use, and is generally prescribed as an alterative. Given with chloride of mercury, the activity of each is increased.

Dose.—Gr. v to gr. x.

SPIRITUS AMMONIÆ AROMATICUS.

Ingredients:

Hydrochlorate of Ammonia,
Carbonate of Potash,
Cinnamon,
Cloves,
Lemon Peel,
Rectified Spirit,
Water.

Decomposition.—The hydrochlorate of ammonia and carbonate of potash decompose each other, forming chloride of potassium, water, and carbonate of ammonia. By heat the latter passes over with the spirit and water, flavoured by the aromatics.

Its specific gravity is ·918.

Medical Uses.—It is a diffusible stimulant and antispasmodic.

Dose.—From ʒss to ʒiss.

SPIRITUS AMMONIÆ FŒTIDUS.

This also is a solution of carbonate of ammonia in spirit, flavoured with assafœtida. It is more frequently prescribed in hysterical and spasmodic affections.

Specific gravity ·861.

Dose.—♏xx to ♏xl.

SYRUPS.

Syrups should be kept where the temperature does not exceed the 55th degree of Fahrenheit's thermometer, otherwise they will undergo the vinous, and subsequently the acetous fermentation.

The only syrup requiring particular notice is—

SYRUPUS PAPAVERIS.

If this syrup be carefully prepared, its strength is such that three drachms of it are equal to one grain of opium; generally it is much weaker, and with most druggists is imitated by other formulæ, such as introducing tincture of opium into it, or the extract of white poppy. This syrup is very liable to ferment, in which case the generated cetic acid is supposed to give it increased activity. From ll these circumstances, the syrup cannot be depended pon, and is unworthy a place in the Pharmacopœia.

TINCTURES.

TINCTURA AMMONIÆ COMPOSITA.

In the present tincture the oil of amber is omitted.

It is a stimulating antispasmodic remedy, and is generally employed by delicate hysterical females in the quantity f five to ten minims in a glass of water for a dose. It is nade with the strong solution of ammonia, and must be sed very cautiously.

TINCTURA CAMPHORÆ COMP.

The present tincture contains oil of aniseed, which ssimilates it more to the old paregoric; it contains about grain of opium in half an ounce.

TINCTURA COLCHICI.

This preparation is made with five ounces of the seeds to two pints of proof spirit; the dose is about half a drachm.

TINCTURA COLCHICI COMP.

This is made with five ounces of the seeds to two pints of aromatic spirit of ammonia. The dose is the same as of the former preparation.

TINCTURA DIGITALIS.

This is made with four ounces of the dried leaves to two pints of proof spirit; the dose is from ten to twenty minims; there are some who give it more largely. It is generally considered that twelve minims are equal in effect to one grain of the powder.

Most tinctures are made with proof spirit, but some of them are made with rectified spirit, and are the following:

Tinct. Assafœtidæ,
Benz. comp.,
Camphoræ,
Castorei,
Cubebæ,
Iodinii comp.,

Kino,
Lavandulæ c.,
Myrrhæ,
Tolutana,
Zingiberis.

VINA. WINES.

VINUM COLCHICI.

This is made with eight ounces of the dried and sliced cormus to two pints of sherry. The general dose is from twenty to thirty minims.

VINUM IPECACUANHÆ.

The strength of this liquid is such, that one ounce may be considered equal to one scruple of the powder; and in smaller quantities, twenty-five minims are equal to one grain.

VINUM OPII.

This is a warm stimulating preparation of opium, adapted to cases of debility, and is used topically; not less than thirty minims ought to be considered equivalent to one grain of opium.

The Student is requested to bear in mind, that the atomic numbers which have been applied to chemical substances in the Pharmacopœia have been intentionally preserved, to correspond with those used by Mr. Phillips in his very excellent translation and commentary, although they may be found to differ slightly from those given in the 'Chemical Notes,' which are made to correspond with those in the last edition of Mr. Fownes' 'Chemistry,' and which, from the latest researches, are supposed to be most correct.

MATERIA MEDICA.

ALTERATIVES

Are medicines which change the functions of the body and restore them to a healthy state, without producing any sensible evacuation.

The principal accredited alteratives are *mercurial* and *antimonial preparations*, in small doses; *sarsaparilla*, *guaiacum*, and *mezereon*.

ANTACIDS, OR ABSORBENTS,

Counteract and neutralise acidity in the stomach and intestinal canal, by their chemical action.

The principal antacids are *chalk*, *magnesia*, *potash*, *soda* and *ammonia*.

ANTHELMINTICS, OR VERMIFUGES,

Are medicines which assist in the expulsion of worms, either by dislodging or destroying them.

The anthelmintics, which act by exciting copious evacuations, and by either killing the worm or expelling its nidus, are *calomel*, *scammony*, *gamboge*, and *spirits of turpentine*.

The mechanical anthelmintics are principally *mucuna pruriens*, *iron filings*, *powdered tin*, *male fern-root*, and *carbonate of iron*.

ANTISEPTICS

Are remedies supposed to be capable of resisting putrefaction.

The principal accredited antiseptics are *vegetable* and *mineral acids*, *cinchona*, *camphor*, *myrrh*, and *opium*.

ANTISPASMODICS

Are remedies supposed to have a specific effect in subduing that muscular contraction called spasm. This is of course effected through the medium of the nervous system.

The principal are *assafœtida*, *castor*, *opium*, *musk*, *galbanum*, *valerian*, *camphor*, and *ether*.

ASTRINGENTS

Are remedies which give rise to a contraction of fibre, by which means less fluid is admitted into the vessels brought in contact with them.

The principal astringents are *sulphuric acid*, *alum*, *sulphate of copper*, preparations of *silver*, *iron*, *zinc*, and *lead ; oak-bark*, *galls*, *tormentilla*, *bistort*, *logwood*, *catechu*, *kino*, *pomegranate*, and *cold*.

CARMINATIVES

Are those stimulating remedies which act by dispersing and preventing gaseous collections, either by increasing peristaltic action, or by some power of preventing the extrication of gases.

The principal are *oil of cinnamon*, *caraway*, *peppermint*, *aniseed*, and *essential oils* in general.

CATHARTICS

Are those medicines which produce an increase of alvine evacuations.

They may be classed under three heads, namely, laxatives, purgatives, and drastics.

Laxatives are digestible substances, and act gently on the muscular coat of the intestine, without causing any noteable increase of secretion from the exhalants. Such are *manna*, *cassia fistula*, *tamarinds*, *figs*, *prunes*, *magnesia*, *olive* and *almond oil*, &c.

Purgatives are substantives not very digestible; they often act on some particular part of the digestive tube, increasing the secretions, and actively augmenting muscular action. The chief of them are *aloes*, *rhubarb*, *jalap*, *senna*, *castor-oil*, *balsams*, and several *neutral salts of soda*, *potash*, and *magnesia*, mild *mercurials*, &c.

Drastics have a still more powerful influence upon both the muscular and mucous coat, causing a brisk action of the muscular fibres, and copiously exciting the exhalants of the mucous coat to pour out watery particles. Such are *elaterium*, *croton-oil*, *gamboge*, *colocynth*, *scammony*, *calomel*, *black hellebore*, *colchicum*, &c. With drastics might be classed *hydragogue cathartics*, which produce copious watery stools, such as *elaterium*, *saline purgatives*, &c.

DEMULCENTS

Are remedies of an oily or mucilaginous nature, which, by their viscidity, protect the intestines from acrid substances.

DIAPHORETICS

Increase the determination of perspiratory fluid to the skin. They effect this either by a general stimulating action on the system, or by relaxing the exhalants, so as to allow a more copious escape of fluid.

The principal are, *antimonials*, *ipecacuanha*, *acetate of ammonia*, *opium*, *camphor*, *guaiacum*, *mezereon*, *sassafras*, and *sulphur*.

DILUENTS

Are those bland fluids which tend to increase the proportion of watery fluid in the blood.

DIURETICS

Are medicines which excite an increased discharge of urine. They effect this in two or three ways. Some diuretics have a direct influence on the secerning vessels of the kidneys, entering them, and becoming perceptible in the urine. Such are *turpentine*, *copaiba*, *asparagus*, *nitre*, &c. Some undergo decomposition in the stomach, and one of their principles only enters the kidneys, as many *neutral salts*, in which the alkali alone passes into the urine. Others appear to act by giving tone to the vascular system generally, and thus, by propelling more fluid to the kidneys, more urine is secreted: a cool surface of the body and exercise are favorable to the action of diuretics.

The chief diuretics are *acetate*, *bitartrate*, and *nitrate of potash*, *nitric ether*, *squill*, *spirit of turpentine*, *copaiba*, *digitalis*, *tobacco*, *mercury*, *cantharides*, and *colchicum*.

EMETICS

Are those medicines which, being received into the stomach, excite the action of vomiting.

These are of three kinds, viz., those which produce immediate vomiting without nausea or depression, but, on the contrary, leave behind them tonic effects; such are particularly the sulphates of copper and zinc. Hence they are most useful in debilitated habits, and in cases of poisoning.

The second class of emetics includes those the action of which is rather tardy, as *tartar emetic*, *ipecacuanha*, &c. They produce considerable nausea, and, after their operation, cause much depression of the system, and are, consequently, most serviceable in inflammatory diseases.

Thirdly, we have stimulating emetics, which are used in very depressed states of the vital powers to rouse the stomach into action, such are *mustard* and *ammonia*.

EMMENAGOGUES

Are those substances which tend to excite the menstrual discharge. Some act on the system generally, by regulating undue arterial action; others excite the torpid action of the uterine vessels by a sympathetic effect, produced by purgatives, which stimulate the rectum.

The principal emmenagogues in common use are *aloes*, *assafœtida*, *galbanum*, various preparations of *iron*, *mustard*, *savine*, and *rue*.

EMOLLIENTS

Are those substances, which applied externally, relax and soften the animal fibre.

The principal emollients are, *unctuous* substances and *liniments*, with *warmth* and *moisture*.

ERRHINES

Are those substances which, being brought into contact with the pituitary membrane, excite the mucous follicles of the nose to increased secretion.

The principal are *tobacco*, *white hellebore*, *asarabacca*, and *euphorbium*.

ESCHAROTICS

Are substances which erode and destroy the parts to which they are applied.

The principal are *potash*, *nitrate of silver*, *mineral acids*, *sulphate of copper*, *chloride of antimony*, and *chloride of zinc*.

EXPECTORANTS

Are substances which produce a discharge of mucus from the lining membrane of the trachea and lungs. This effect is accomplished in two ways. In the first place, certain substances in a gaseous state received into the lungs stimulate the air-cells, and excite the respiratory muscles into action, by which means mucus is expelled by powerful coughing; some emetics may be considered to be of service in a similar manner. In the second place, there are medicines which, when received into the system, produce a powerful action on the exhalants, causing them to throw out a less viscid and more abundant fluid, which is expelled without much difficulty, and it is very probable that the vessels of the mucous bronchial lining are affected by sympathy with the stomach.

The principal expectorants are, *antimonials*, *ipecacuanha*, *squills*, *digitalis*, *tobacco*, *stramonium*, *ammoniacum*, and the *balsams*.

LITHONTRIPTICS

Are substances which are supposed to act on urinary calculi.

They are *soda*, *potash*, *lime*, *magnesia*, and some of the acids.

NARCOTICS

Are medicines which induce stupor, and generally alleviate pain, partly either by a stimulant, or sedative action.

They act primarily on the stomach by an impression on the nervous system, independent of absorption; for, in cases of death arising from them, they have been found in the stomach undiminished in quantity in the smallest degree; they also act on the nerves when externally applied.

The principal are *opium*, *hemlock*, *henbane*, *aconite*, *stramonium*, *belladonna*, *lactuca*, *tobacco*, *hops*, and *camphor*.

SEDATIVES

Are substances which directly depress the vital powers, diminishing sensation and the power of motion without any previous excitement, but acting most powerfully on the nerves of sensation; in the medical application of them they are of service to reduce preternaturally increased action.

The general effects of them, in different degrees of intensity, are prostration of strength, stupor, sense of numbness, depressed animal spirits, drowsiness, yawning, vertigo, and enfeebled mental energy.

The principal sedatives are *hydrocyanic acid* and *tobacco, tartarized antimony, opium* in full doses, &c.

SIALOGOGUES

Increase the secretion and discharge of saliva.

The principal are *tobacco, pellitory*, and *mercury*.

STIMULANTS

Are medicines which excite the various functions of the body, giving energy to the stomach, increased power to the heart, augmenting the secretions, and adding to the sensibility of the nervous system.

The principal effects experienced from them are—increased appetite, with a sense of warmth internally, more rapid action of the heart, increased power in the pulsation of the arteries, warm skin, with the minute vessels more injected with blood, the respiration accelerated, increased flow of urine, and the sensorial functions developed in a greater degree.

Stimulants in moderation have an action analogous to tonics, but their effects are less permanent. In large quantities they act as narcotics.

The principal stimulants are *alcohol, ether, volatile oils, camphor, ammonia*, and *aromatics generally*.

TONICS

Are those substances which restore the healthy tone of the stomach. They are supposed to act by increasing muscular power; but it is more probable that they are beneficial by checking the inordinate excitement or irritability of the stomach and viscera.

The principal are sulphate of *zinc* and *iron*, *acids* in small doses, and the *various bitters*, such as *cinchona*, *gentian*, &c.

ABIETIS RESINA.

The resin named Thus, procured from the Pinus Abies.

The tree which principally affords this substance grows abundantly in the northern parts of Europe and Asia, attaining an elevation of from 100 to 150 feet, sometimes with a trunk of from three to five feet in diameter. The resin is a natural exudation from the stem. Some authors ascribe it to other species, or give other names to the same tree, such as Abies communis, or Abies excelsa.

This substance has been known in former Pharmacopœias under the name of Thus, or Frankincense. It is chiefly imported from Germany and Switzerland.

Medical Uses.—It is employed as an ingredient in plasters, being mildly rubefacient.

Preparations.—Empl. Ferri c.,—Empl. Galbani,—Empl. Opii,—Empl. Picis,—Empl. Potassii Iodidi,—Thus Præparatum.

ABSINTHIUM.

Artemisia Absinthium.—*Wormwood.*

This plant is indigenous, and also grows freely in most European countries. It is perennial and herbaceous; attaining a height of two or three feet; the radical leaves are triply pinnatifid, with lanceolate, obtuse dentate divisions; those of the stem doubly or simply pinnatifid; the floral leaves are lanceolate; all are hoary; the flowers are small, pedicelled, nodding, and in erect racemes.

The leaves and flowering tops only are used medicinally, and should be gathered in July and August. Wormwood has a strong odour, and a very bitter nauseous taste, which qualities are imparted to water and alcohol. A dark green volatile oil is obtained by distillation, and on this the odour depends. Braconnot discovered on analysis,

A very bitter azotized substance; an excessively bitter resinous matter; green volatile oil; chlorophylle; albumen; starch; saline matter; lignin.

Amongst the saline substances, potash exists in combination with a peculiar acid, which Braconnot named Absinthic acid. The ashes of this plant yield a large quantity of carbonate of potash, which has hence been named *salts of wormwood.*

Medical Properties.—Wormwood is considered to be tonic and anthelmintic. As a tonic, it has been prescribed in many diseases attended with weakness of the digestive organs, and was once in repute in the treatment of intermittent fevers. As an anthelmintic, its virtues are not very decided.

Dose.—Of the powdered leaves, from one to two scruples: or an infusion may be made with an ounce of the leaves to a pint of water, and an ounce of it taken two or three times a day.

Some other varieties of Artemisia have at times been used medicinally.

The *A. Abrotonum*, southernwood, is considered to be tonic, deobstruent, and anthelmintic.

A. Santonica has a similar character given to it.

A. Pontica acts similarly, but is weaker.

A. Vulgaris, or mugwort, has been used in Germany for the cure of epilepsy, by Dr. Burdach.

A. Chinensis and *Indica*, are said to afford, on their leaves, the soft substance employed in China for the formation of moxa.

ACACIA.

The gum, a natural exudation from the ACACIA VERA.

The tree specified in the Pharmacopœia, affords but a small share of the gum Acacia, which is imported. The other trees mentioned by travellers, are enumerated below. Still the best gum is the produce of the *A. Vera* and another species closely allied to it, viz., the *A. Arabica.*

The *Acacia Vera* is a tree of a middling size, with branches, bearing doubly-pinnate leaves; its flowers are yellow, collected into globular heads; the fruit is a flattened legume, divided by contractions into several rounded portions, each containing a seed. This tree flourishes in Upper Egypt and Senegal, and is scattered over the intervening Continent.

The *A. Arabica* is most frequently a small shrub, but occasionally attains the size of a large tree. Its leaves are doubly-pinnate, and its seed-vessel resembles that of the former species. It grows in Upper and Lower Egypt, Senegal, many other parts of Africa, in Arabia, and is abundant in Hindostan, where its gum is eaten as food by the natives. Amongst the other varieties of Acacia, affording this gum, are enumerated, the *A. Senegal*, said to form vast forests in Senegal.—*A. Gummifera*, seen near Mogador.—*A. Ehrenbergiana*, found in the deserts of Lybia, Nubia, and Dongola.—*A. Seyal*, found in the same countries and Upper Egypt.—*A. Tortilis*, inhabiting Arabia Felix, and Nubia. A similar gum is procured, in New Holland, from the *Acacia decurrens* and *floribunda*. In Hindostan, the gum of the *Feronia elephantum* is largely used by the practitioners of Lower India.

The gum-bearing Acacias are all thorny or prickly trees, or shrubs, flourishing in sandy deserts, or soils where few other things will grow. In such countries the camels are said to derive from them their chief support; their bark, and unripe fruit, contain tannin and gallic acid. Formerly an extract was procured from the unripe fruit, and was known under the name of *Acaciæ veræ succus*. An imitation of it is said now to be made on the Continent, from the unripe fruit of the wild plum-tree.

The gum of Acacia exudes spontaneously in the hot and dry seasons, and in hot countries only; the most sickly trees afford it in the greatest abundance; its exudation is also assisted by incisions; the colour and appearance of the gum do not alone indicate different sources, as the gum varies considerably, coming from the same tree, requiring to be assorted before being delivered into commerce.

Gum Acacia may be taken as the type or purest form of the proximate principle named gum, or arabin, by chemists. It is distinguished by its solubility in water, forming a thick viscid liquid, called mucilage. It is precipitated from its solution by alcohol, diacetate of lead, and silicate of potash, which are the best tests of its presence. It is miscible with dilute acids and alkalies; is decomposed by the strong concentrated acids, as nitric and sulphuric; the former, by acting upon it, produces mucic, malic, and oxalic acids; the latter disengages acetic acid and charcoal.

Gum Acacia generally contains a small quantity of free acid, as its solution reddens litmus paper, also a minute quantity of phosphate and carbonate of lime. The gum which obtains the highest price is whitest, in rounded masses, semiopaque, exhibiting a great number of cracks all through it; when broken, the small separate pieces are transparent. The inferior gum is darker coloured, with various shades of yellow and red, and with a more smooth and uniform surface.

Medical Properties.—Gum Acacia is demulcent and mildly nutritive. As a demulcent, it may be used in inflammation or irritation of mucous membranes, generally, as in catarrh, bronchitis, enteritis, gastritis, gonorrhœa, &c. It is likely to do good by lubricating the surfaces to which it can be directly applied, and by protecting them from the action of stimulants and irritants.

As a nutritive agent, gum is of the mildest character, being less stimulating than any other form of nourishment. It is therefore used advantageously in fevers, in solution, considerably diluted. As a proof of its nutritious qualities, the Moors, who collect it, and inhabitants of many parts of Africa, will live upon it alone for several days together.

In pharmacy, it is useful to mix with heavy substances, in the form of powders; and, in mixtures, to hold in suspension insoluble ingredients.

Dose.—Ad libitum.

Prep.—Mistura Acaciæ,—Mistura Moschi,—Mistura Guaiaci,—Pulv. Cretæ Comp.,—Pulv. Trag. Comp.

ACETUM.

Vinegar is a sour liquid, containing acetic acid, and several impurities. In the various countries, different substances are employed to make it.

In England it is commonly made from malt liquors, but in some counties from cider.

In France, and the Continent generally, it is procured from wine.

In North America, cider is chiefly used.

The requisites for acetous fermentation are saccharine vegetable matter, moisture, heat, something to excite fermentation; and it goes on better with the free access of atmospheric air; the change which ensues in its formation is essentially the oxidation of alcohol. When sugar, water, and yeast are mixed together, and exposed to a certain temperature and access of atmospheric air, vinous fermentation first takes place; the sugar is decomposed and alcohol is formed: if the fermentation be allowed to proceed, the alcohol will be decomposed, and acetic acid will appear.

The impurities of vinegar will vary with the substances used to procure it. In our own vinegar we generally find mucilage, colouring matter, aroma, and some sulphuric acid. The last is allowed by government to be added in the proportion of one part in a thousand. Vinegar is strengthened in Germany by exposing it to the air to be frozen. The water freezes first, leaving the vinegar in a very strong state.

Vinegar is sometimes impregnated with small quantities of metallic salts, from the vessels used in the preparation. We find occasionally traces of copper, lead, and tin, and it is also stated that nitric and hydrochloric acids are sometimes added, which, I should say, is an exceedingly rare occurrence; they can all be detected by the usual tests employed for each. The quantity of real acid in the best vinegar is about five per cent.

Medical Uses.—Vinegar is refrigerant, and supposed to be antiseptic, but not often used internally. It may be given in inflammatory and typhoid fevers, and in cases of poisoning by narcotics, after the stomach has been completely emptied. For the latter purpose, it was once much employed in poisoning by opium; this practice, however, is now discontinued, because the acid rather increases than diminishes the effect of that narcotic, if any portion remains in the stomach. If, however, it could be accurately known that all the opium was expelled, there could be no objection to its use. The vapour of it is often inhaled with advantage in inflammations of the tonsils; and this vapour is diffused through rooms, to decompose noxious effluvia. It is most employed externally, in the form of lotion, for bruises and sprains; and may be rubbed on the chest or other parts of the body, to act as a rubefacient.

Dose.—ʒij to ʒvj.

Prep.—Acetum Destillatum,—Ceratum Saponis,—Linimentum Æruginis.

ACIDUM ACETICUM. (*Vide* p. 16).

ACIDUM ARSENIOSUM.

Arsenious Acid, commonly known as White Arsenic.

This substance is usually procured in Saxony and Bohemia, by roasting or smelting cobalt ores, in which metallic arsenic is a large ingredient; and in Silesia and Cornwall, from arsenical iron pyrites (*mundic*, or *mispickel*). By the heat, metallic arsenic rises, and immediately combines with oxygen of the atmosphere, and forms arsenious acid, which is deposited in flues; it is removed from thence and purified by subsequent sublimation. When first obtained, it is in large masses, transparent like glass, which become opaque by exposure to the air, and then very much resemble porcelain. This change of appearance is also attended with a change in specific gravity, which, however, is not precisely determined; it is also rendered more soluble. This acid is generally kept in shops in the form of powder, and consequently may be easily adulterated; on account of which it is recommended to sublime the acid for medical purposes after purchasing it in the usual way. It may be adulterated easily with chalk, carbonate of lead, and sulphate of lime; and as these are not volatilized by heat, the acid can be removed from them by the sublimation. This substance has no decided taste, although soon after being taken into the mouth an acrid sensation is experienced. It is soluble in water, 1000 parts of which, at 60° F., will dissolve about 9½ of arsenic. It appears that if this acid be dissolved in boiling water, the liquid on cooling, will retain more acid than could be dissolved by the water used cold.

Composition:

1 arsenicum = 75
3 oxygen = 24
—
99

Formula AsO^3.

Medical Properties.—Tonic, alterative, in large doses irritant, and, externally applied, may become escharotic. The principal diseases in which it is given internally, are intermittent fevers, neuralgic affections, nervous diseases, epilepsy, chorea, and some skin diseases, as lepra and psoriasis. It requires to be administered with caution, as it possesses somewhat of an accumulative action; and if given in doses, even slightly too large, it causes an unpleasant train of symptoms, most of which may be referred to an inflammatory condition of the stomach. The symptoms ordinarily complained of are, sense of fulness in the pharynx and œsophagus, with dryness, pain and heat at the stomach; then nausea and sickness, a feeling of itching, tightness and pain about the forehead and temples, œdema of the eyelids and face, or other parts of the body, known by the name of *œdema arsenicalis;* to these may be added griping and purging, with a feeble pulse; when these symptoms show themselves the medicine should be laid aside, or diminished in quantity, and cooling purgatives and saline antiphlogistic remedies must be given; although arsenious acid is sometimes very useful, it should not be too hastily and freely prescribed; for in some persons it injures considerably the tone of the stomach, which months, and even years, may not restore, so that always when it is given its effects should be carefully watched.

In agues, it should be used only when cinchona, in its various forms, has failed. Sometimes it acts better with cinchona, than either given alone. In respect to the period of giving it, the stomach bears it best after a meal; if taken on an empty stomach, even in very small doses, it occasions very disagreeable gripings.

The modus operandi of this remedy is not very intelligible, for it does most good when its effects are least sensibly perceived. It cannot be proved to act by counter-irritation, or by promoting any particular discharge; therefore, as a refuge, we fly either to the blood or the nervous system.

As an external application, arsenious acid is used for cancer of the lip, and for many other cancerous diseases; and, indeed, it is an ingredient in most of the quack remedies which have been advertised for the cure of that form of disease. When applied externally, it appears to destroy the vitality of the morbid parts, before it attacks the healthy structures; but at the same time we must recollect that, thus applied, it has been absorbed into the system, and oftentimes proved fatal. It is also applied in cases of lupus, and other ill-conditioned sores about the body. In India it has been considered to be an antidote for the poison of serpents, but on insufficient grounds.

Poisonous Effects.—In large doses, arsenious acid is a very virulent poison. Not being very soluble, its effects are not much felt before half an hour. When they manifest themselves, there is heat and pain at the stomach, dryness and sense of constriction in the throat, then vomiting, with violent retching efforts, and blood brought up; the bowels are griped and purged, blood is discharged, there is severe tenesmus and heat in the rectum, the pulse is rapid and becomes gradually weaker, and, towards the last stage, there are sometimes convulsions. In some cases, where it does not kill, it produces paralysis of the extremities. A host of other symptoms are enumerated by toxicologists, but they are not sufficiently constant to be much insisted upon. Occasionally, arsenic has destroyed in a few hours, without one of the above symptoms having manifested itself.

Treatment.—Vomiting, if established, should be encouraged; if not, it should be excited by doses of sulphate of zinc. There is no certain antidote, although the hydrated sesquioxide of iron is, by many, considered as such. To be efficient, the oxide should be recently prepared, either from the Tinct. Ferri Sesquichl., acted on by liquor ammoniæ, or it may be made by precipitation with ammonia or potash from the sulphate of iron previously dissolved in water and peroxidized by nitric acid. A table-spoonful may be given to an adult every ten minutes, at the same time keeping up the vomiting. It is considered to act by forming an arsenite and arseniate of iron of sparing solubility. The advocates of its use are far more numerous than its opponents; and inasmuch as the antidote can do no harm, but may do much service, I consider that it should always be employed in poisoning by arsenic. Magnesia and charcoal, as antidotes, have also their advocates. Lime might be given in the form of chalk, stirred up and mixed with milk. Albumen is considered to be a good remedy at the commencement. It appears to be of service by enveloping the particles of arsenic, causing them to be more easily evacuated, and may sheath the stomach from the action of the poison. Afterwards, copious demulcents, oily purgatives, and refrigerant antiphlogistic remedies, are to be employed; and the diet, very mild at first, may gradually be made more substantial.

The usual morbid appearances from arsenic, taken internally, are some redness about the fauces and œsophagus. The mucous coat of the stomach is soft, pulpy, highly inflamed in patches, with particles of the arsenical substance often remaining in the centre of them, unless the vomiting has been very free; ulceration has occasionally been found; there are inflammatory patches in the duodenum; little to be observed in the rest of the alimentary canal, excepting the rectum, which is usually found highly inflamed, with the vessels gorged with blood. Arsenic destroys life, partly by the inflammation it establishes, but chiefly by its effects on the blood and nervous system.

Tests for Arsenious Acid.—In testing for arsenic, if the ejected liquids are lost, the body must be opened, and the stomach be carefully removed. On opening it, any solid particles or the fluid contained in it should be carefully put aside. Then the stomach may be cut into pieces, boiled in water with charcoal to decolorize, and acetic acid may be added to precipitate animal matter. The liquids should then be filtered and separated into several portions for the application of the various tests, which are the following:

Sulphuretted hydrogen, now named hydrosulphuric acid, causes, in a solution of arsenic, a yellow precipitate, the sulphuret of arsenic, the hydrogen, and oxygen forming water. In transmitting this gas through the liquid, care must be taken not to force it through in excess, as the sulphuret is soluble in excess of the reagent. Suppose the gas to have been passed through too freely, the excess may be expelled by heat, and the yellow sulphuret will then fall. This yellow substance should next be submitted to the test of reduction. For this purpose it should be dry, and be mixed with black flux, and carefully introduced into a dry glass tube; then heat is to be applied to it, by means of a lamp, and the atmospheric air must be excluded by paper or the finger on the top. By the heat, metallic arsenic should rise, and be condensed on the side of the tube in the form of minute crystals, of a steel-grey colour and lustre. The decomposition which occurs, is supposed to be the following: The sulphur decomposes the potash; and the consequence is the formation of sulphate of potash, and sulphuret of potassium and metallic arsenic is liberated. Whilst this is rising, it evolves an odour likened to garlic, which may be perceived by applying the nose to the opened end of the tube. If the metallic arsenic be again heated, and air be admitted, it becomes white, by absorbing oxygen, and the conversion into arsenious acid.

The liquid tests for arsenic are, ammoniacal sulphate of copper, and ammoniacal nitrate of silver; lime-water is mentioned, but is of little value. The ammoniacal nitrate of silver causes a yellow precipitate of arsenite of silver, nitrate of ammonia remaining in the solution.

The ammoniacal sulphate of copper produces a grass-green precipitate of arsenite of copper, named Scheeles green, and sulphate of ammonia remains in solution.

The lime-water affords a white precipitate of arsenite of lime.

Either of these precipitates admits of reduction of the arsenic to the metallic state, by heat and charcoal.

Another test for arsenic has been discovered, and of the greatest importance, commonly called the hydrogen test, and we are indebted for it to an ingenious chemist, the late Mr. Marsh. The suspected liquid is to be introduced into a glass vessel; and in it put a piece of metallic zinc and a little dilute sulphuric acid; by the chemical action which ensues, hydrogen, which is disengaged from the water, combines with arsenicum, and rises in the form of arseniuretted hydrogen gas, which is allowed to pass off by a fine tube. If a flame be applied to this gas during its escape, it will burn and produce water and arsenious acid; and if, during its process, a piece of cold glass be put over, close to the burning gas, we impede the combustion partially, and find deposited on the glass some white arsenious acid, with a little metallic arsenic in the centre of it.

The chief objections to this test are, that the zinc, sulphuric acid, and apparatus, may contain arsenic; and that antimony produces a very similar deposit: but these objections may be done away with by trying the apparatus with the zinc and acid, without the suspected liquid, and if no arsenic appears until the latter is added, it is quite safe to infer that arsenic was only in the suspected fluid. Antimony may be distinguished by the other tests of the separate metallic salts.

The last test was suggested by Reinsch, who places some clean copper in the suspected liquid, and then drops in some pure hydrochloric acid, and applies heat, in which case metallic arsenic is deposited on the copper, and may be separated by sublimation.

Dose.—Five minims of liquor potassæ arsenitis, three times a day, and may carefully be increased to fifteen minim doses.

Two drachms of liq. potassæ arsenitis contain one grain of arsenious acid.

Prep.—Liq. Arsenici Chloridi,—Liq. Potassæ Arsenitis.

ACIDUM NITRICUM.

(*Vide* Chemical Decompositions of 'Pharmacopœia,' p. 20.)

ACIDUM BENZOICUM.

Benzoic acid is best prepared according to the process of the London Pharmacopœia, 1836.

By the application of heat to benzoin, benzoic acid rises, and condenses in the upper part of the apparatus. It is afterwards pressed between bibulous paper, to separate some oil which proceeds from decomposition of a portion of the resin. The acid is a second time sublimed.

Benzoin is not a gum-resin, but a compound of benzoic acid and resin, with a small quantity of a powerful aroma. We usually procure about 12 per cent. of acid from it. Benzoic acid may also be obtained by boiling benzoin in water, with carbonate of lime. The benzoate thus formed is decomposed easily by hydrochloric or sulphuric acid; and the benzoic acid, from its sparing solubility, falls. It requires 200 times its weight of cold water for solution. When properly prepared, it should easily be volatilized by heat, readily dissolved by alcohol, sparingly by water; soluble in a solution of potash or lime; and be precipitated from such solutions by hydrochloric acid.

Benzoic acid is a compound of a principle named benzule and oxygen, and cannot exist uncombined with water. The composition of the anhydrous acid is:

14 carbon	14 × 6 =	84
5 hydrogen	5 × 1 =	5
3 oxygen	3 × 8 =	24
		113
The crystals contain one water		9
Atomic number . .		122

Formula $C^{14}H^{5}O^{3}, HO$.

Medical Properties.—It is of no essential service as a medicine. Some imagine it to be a stimulating expectorant, and antispasmodic. It is most used on account of its odour.

Prep.—Tinct. Camphoræ Comp.

ACIDUM CITRICUM.

This acid is best prepared in the following manner:

Ingredients:

Lemon Juice,
Prepared Chalk,
Dilute Sulphuric Acid,
Distilled Water.

Decomposition.—In procuring this acid, the citric acid of the lemon-juice first combines with the lime, forming an insoluble citrate of lime, and carbonic acid is disengaged. The citrate of lime is then decomposed by sulphuric acid, which unites with the lime, forming a comparatively insoluble sulphate of lime, and soluble citric acid is set free, and obtained in crystals by evaporation.

The object of this process is to separate the pure acid from the mucilage, which is washed away when the lime has united with the citric acid. The quantity of acid obtained from lemon-juice is about 11½ drachms from a pint. The saturating power of citric acid with the alkalies usually employed may be seen by the following table:

		citric acid.	*lemon juice.*
℈j. of bicarbonate of potash	requires for saturation	gr. 14	ʒiijss.
℈j. of carbonate of potash		gr. 17	℥ss.
℈j. of sesquicarbonate of ammonia		gr. 24	ʒvj.

Composition of anhydrous citric acid, which is now called tribasic:

12 carbon 6 × 12 = 72
5 hydrogen 1 × 5 = 5
11 oxygen 8 × 11 = 88
165

The ordinary tribasic acid contains 4 equivalents of water.

Medical Properties.—Refrigerant and sedative, always given in combination with some alkali. It is preferable to tartaric acid, when we wish the neutral salt not to relax the bowels.

Dose.—Of the acid, ℈j; of lemon-juice, ℥ss.

ACIDUM GALLICUM.

Gallic acid was once considered to exist ready formed in plants; but the view now taken of it by most is, that it is an educt of changes effected upon tannic acid, viz., that it results from the oxidation of tannic acid, and is thus represented:

tannic acid. *gallic acid.* *carb. acid.* *water.*

$$C^{18}H^{8}O^{12} + O^{8} = 2\,(C^{7}H^{3}O^{5}) + 4\,CO^{2} + 2\,HO.$$

Gallic acid is usually procured from an infusion of nutgalls, exposed to the air for some time. A pellicle forms upon the surface repeatedly, and is removed, and a crop of crystals will be found at the bottom of the vessel, which are purified by animal charcoal, and repeated solution in water. It is quite colourless, when pure, and does not form a precipitate with gelatine.

Medical Properties.—This acid possesses nearly the same properties as tannic acid, but is less efficacious as a topical agent (*vide* Tannic Acid). Some, however, esteem it highly, as Dr. Todd, who states that he considers it to be the most valuable styptic we possess, in all cases of hæmorrhage, or of hæmorrhagic tendency.

Dose.—Gr. iij to gr. x.

ACIDUM TANNICUM.

Tannic acid, formerly called tannin, is contained in many vegetable substances, and variously modified, but is most abundantly and conveniently obtained from the gall-nut.

It is procured by acting upon gall-nuts with ether, containing about 10 per cent. of water. The acid taken up by this liquid is gradually precipitated, and, by repeated washing with ether, is procured in a pure state, having a slightly yellowish white colour.

Formula $C^{18} H^{8} O^{12}$.

It is distinguished from gallic acid by its great affinity for gelatine, forming with it an insoluble tannate of gelatine, the basis of leather.

Medical Properties.—This acid possesses, in a concentrated degree, the properties of nut-galls. It is highly astringent and tonic, and has been prescribed in nearly all diseases attended by excessive discharges and laxity of tissue, and in most cases with decided effect. The diseases in which it is most used are, hæmorrhages, diarrhœa, dysentery, gonorrhœa, leucorrhœa, night sweats of phthisis; topically, for sore nipples, spongy gums, gonorrhœa, leucorrhœa, open cancer, and is looked upon as an antidote for tartar-emetic and the alkaloids.

Dose.—Gr. iij to gr. x.

ACIDUM HYDROCHLORICUM.

(*Vide* CHEMICAL DECOMPOSITIONS, p. 18.)

ACIDUM SULPHURICUM.

Sulphuric acid, oil of vitriol. This powerful corrosive acid is procured in several ways, most of them modifications of the process described with the Decompositions of the Pharmacopœia. The manufacturers of it preserve the strictest secrecy about any trifling improvement, to an extent which astonishes, when we consider the low price of the article.

Sulphuric acid is seldom quite pure; it generally contains a small quantity of sulphate of lead, which is often seen in the form of a white flocculent precipitate, when the acid is diluted with water; and it is this or a trace of arsenic which slightly colours the acid, when hydro-sulphuric acid is transmitted through it.

By mixing four parts of sulphuric acid with one of water, such condensation of volume takes place as to evolve heat of the temperature of 300°.

There is another variety of this acid, called fuming sulphuric acid, and named Nordhausen, from a place in Saxony, where it is prepared. It is procured from the sulphate of iron by great heat. Its specific gravity is nearly 1·9, and it contains only one equivalent of water to two of anhydrous acid. By distilling slowly this acid into receivers surrounded with ice, it may be obtained in delicate crystals, very much resembling asbestos.

Composition of the anhydrous acid:

3 oxygen	$3 \times 8 =$	24
1 sulphur	$=$	16
		40

The liquid acid contains:

1 water	$=$	9
		49

Formula SO^3, HO.

Medical Properties.—Sulphuric acid in a diluted form is tonic, astringent, and refrigerant. As a tonic, it is employed after long fevers, when the stomach is yet enfeebled, or the vessels are in a relaxed condition: for this object it is mostly given with bitter infusions, and especially combined with cinchona in its various forms. As an astringent, it is useful in hæmorrhages from the lungs, stomach, uterus, or other parts, and may be given either in the active or passive states. In these cases, it not only benefits by its local action, but produces, by sympathy, a similar impression on vessels in other parts, and also has a sedative influence upon the heart. It will check diaphoresis, especially that sweat which occurs in hectic fever. It may act as a refrigerant by its sedative qualities, in a similar manner to many other acids.

Dose.—Of dilute sulphuric acid, ten to thirty minims.

Sulphuric acid in an undiluted state is a powerful poison, rapidly destroying all the parts with which it comes in contact. If taken in large doses, the lips and lining membrane of the mouth are found blackened; the epidermis separates in patches; there is severe pain and sense of constriction in the throat, a discharge of salivary fluid from the mouth, violent pains in the stomach and bowels, vomiting of blood and black matter, sometimes purging of blood and mucus; the pulse sinks, and the patient dies in a short period.

The treatment consists in administering antidotes, such as magnesia or chalk, with demulcent drinks; milk is a good vehicle for the antidotes. If the patient survives the first shock, demulcents and antiphlogistic remedies are indicated.

The morbid appearances from this acid, are destruction of the soft parts about the mouth and fauces, a charred blackened state of them, with detachment of the epidermis. The blackness distinguishes this acid from other mineral acids; the stomach is highly reddened, in parts almost black, the mucous membrane is partly removed, and there is black blood and coagula in the stomach. A similar state, but modified, may be seen in the other parts of the alimentary canal.

In testing for sulphuric acid, there is not so much difficulty as in many other cases. We have a certain test for it in the soluble salts of baryta, any of which, with sulphuric acid, forms a sulphate, insoluble in all other acids.

Sulphuric acid is much used in pharmacy, and will be found to be an ingredient in many preparations.

ACONITI, FOLIA ET RADIX.

The leaves and root of ACONITUM NAPELLUS, *Monkshood.* This plant, as well as other varieties of Aconite, has an annual stem, with perennial roots. It is a native of central Europe, and is cultivated and grows readily in our country.

The fresh leaves have a faint narcotic odour, more so when they are rubbed; their taste is at first bitterish, afterwards burning, very acrid, and durable; when long chewed they inflame the tongue. Similar properties are possessed by the root, from which alone aconitine was directed to be prepared in the London Pharmacopœia. From the analysis of Aconite, which has not been very accurately performed, chemists have discovered, in the leaves more especially, resin, gum, wax, extractive matter, lignin, malates, and citrates of lime, and other saline matters. Brande considered the active principle to be an organic alkaline substance, for procuring which we had a formula in the London Pharmacopœia.

Aconitine is soluble in ether, less so in alcohol, very sparingly in water. By heat it is entirely dissipated. It is colourless, granular, not crystallizable, inodorous, with a powerful bitter acrid taste. From experiments with it upon animals, it is a most powerful poison in even very small quantities, and appears to kill by its operation on the nervous system, inducing weakness of the muscles, and exhausting the heart's action.

Medical Properties.—Aconite, in the form of the powdered leaves, or extract, has the character of being an anodyne, diaphoretic, and diuretic. It was formerly in much repute, but now from its uncertain operation in the hands of many practitioners, has fallen almost into disuse. Its most obvious effect is that of subduing pain in several affections, which we can accomplish by more safe and certain remedies. The diseases in which it has been most given are rheumatism, gout, secondary syphilis, cancer, some skin diseases, amaurosis, paralysis, epilepsy, intermittent fever, and dropsies. In poisonous doses it produces the symptoms that arise generally from narcotico-acrid poisons. The morbid appearances from it are, inflammation of the stomach and bowels, and engorgement of the vessels of the brain and lungs.

Aconitine has been brought before the public by Dr. Turnbull, who found it to be a powerful agent in alleviating pain in several diseases. He used it chiefly as an external application in the treatment of rheumatism and neuralgic affections: the form for employing it is in an alcoholic solution in the proportion of 1 grain of aconitine to a drachm of alcohol, or an ointment containing 2 grains to 1 drachm; a small quantity of either of these is rubbed on the affected parts night and morning. It produces a sense of warmth, and is said in a most extraordinary manner to subdue the pains for which it is applied. More cases are required to confirm its efficacy, before we can receive it as one of our safe and standard remedies.

Dose.—Of aconite leaves, gr. j to gr. iij.
of the extract, gr. ¼ to gr. j.
of the tincture, ♏iv to ♏x.
Prep.—Extr. Aconiti,—Tinct. Aconiti.

ADEPS.

Lard, the fat of the Sus Scrofa.—*Common Hog.*

Lard is the fat which is found in the omentum, mesentery, surrounding the kidneys, and under the skin. This fat having been deprived of membranous matter, is cut into pieces, washed to remove any blood, then melted, sometimes with some water, over a slow fire. After the water is evaporated, and the whole is melted, it is strained through linen, and poured into suitable receivers. Lard often contains some salt, which may be removed by washing, or melting it in water, from which, on cooling, it separates.

Lard melts at about 100 degrees; one hundred parts consist of

62 elaine,
38 margarine and stearine.

According to Dr. Turner, it is a mixture of stearine, margarine, and oleine.

Exposed to the air, lard absorbs oxygen, and becomes rancid, in which state it irritates the skin, and is unfit for combination with substances that are occasionally mixed with it in pharmacy.

Medical Properties.—Emollient, chiefly used in the form of ointments and cerates; it is sometimes mixed with poultices, to prevent their adhesion to the skin, and is added to laxative enemata.

Prep.—It enters into several ointments.

ÆRUGO.

Verdigris.—An Impure Diacetate of Copper.

This substance is prepared chiefly in the South of France, in the neighbourhood of Montpelier, and is procured in the following manner: Sheets of copper are placed amongst the refuse husks of the grape, after the juice has been squeezed out, and allowed to remain for some weeks, during which time the copper is thickly coated with verdigris. This is scraped off and the copper is again used. After being collected in sufficient quantity, the scrapings are formed into a paste, which is beaten with mallets, then packed up in leathern bags, and exposed to the sun. The copper is acted upon by the acetic acid, formed by the acetous fermentation which occurs in the vegetable matter.

Verdigris is in masses of a pale green colour, consisting of minute silky crystals; sometimes it is of a bright blue. It has a strong coppery taste. When acted upon by sulphuric acid, effervescence takes place, and an odour of acetic acid is evolved. In commerce it contains 2 or 3 per cent. of impurities, consisting of particles of copper, or the husks and stones of the grape. The greenish substance found in copper vessels, not kept clean, is a carbonate of copper.

Verdigris is also made in this country, by exposing thin sheets of copper to acetic acid and its fumes, or by placing sheets of copper, alternately, between woollen cloths steeped in acetic acid: the copper becomes oxidized and then unites with the acid.

It is partially soluble in water, and almost entirely in ammonia, or dilute sulphuric acid.

Composition:

2 oxide of copper	2 × 40	= 80
1 acetic acid		= 51
6 water	6 × 9	= 54
		185

Formula $2\ CuO, C^4 H^3 O^3, 6\ HO$.

Medical Properties.—Tonic, astringent, emetic, and externally detergent and escharotic. For internal use it is not a good remedy. It has occasionally been given in epilepsy and chorea. As an emetic, it is uncertain in its operation, and if retained on the stomach, will act as a poison. To counteract its poisonous effects, the remedies employed are albumen, sugar, and coffee, and free vomiting should be encouraged.

As a topical remedy, it is applied to fungous growths and to unhealthy ulcers; in which it induces a more healthy action after destroying the morbid surface of them.

Dose.—As a tonic, $\frac{1}{16}$ to $\frac{1}{4}$ of a grain.
As an emetic, 1 to 3 grains.

Prep.—Lin. Æruginis.

ALOE.

The inspissated juice of the leaves of ALOE SOCOTORINA, ALOE SPICATA, BARBADENSIS, and other unknown species.

There are three varieties of aloe now designated by the London Pharmacopœia; but it is doubtful whether the names given to the plants be correct. The *Aloe Vulgaris* or *Barbadensis*, is most agreed upon; the *Hepatic Aloe* is most questionable on account of the ambiguity of the term, for it applies to appearance, not to any specific plant; and it seems that hepatic aloe is produced in all the localities from which the other varieties are obtained: Dr. Pereira describes very distinctly seven varieties of aloes, which will be found clearly defined in his work on 'Materia Medica.'

The commercial varieties are principally three: the *Cape*, *Socotrine*, and *Hepatic* or *Barbadoes*.

The *Cape Aloes* is very abundant and cheap. It has a very shining, vitreous appearance when fractured; its odour is very strong and unpleasant, and the colour of it is more inclined to a green than the other varieties. The powder has a greenish yellow colour. It is imported in casks or boxes.

Socotrine Aloes is produced partly in the island of *Socotra*, and a part on the eastern coast of Africa. The precise species of aloe which affords it is not known. It is obtained by expressing the juice of the leaves, allowing it to stand, that impurities may subside, then pouring it off and drying it in the sun; when sufficiently hard it is introduced into skins, and exported. A portion of it is sent up the Red Sea, and passes through the ports of Malta and Smyrna; and from thence to our country. Another portion finds its way to Bombay, from which place also it reaches us. This species of aloes varies vastly in its appearance, in the markets and shops. Lately, some has come to us of a bright red appearance, translucent, and possessing a pleasant odour, and a more aromatic and agreeably bitter taste, than we usually receive it. Ordinarily, it has a reddish-brown colour, breaking with a conchoidal fracture, with translucent edges; the powder has a bright golden colour, and the odour is far from unpleasant. It appears, too, that much of the aloes sold as socotrine comes even from the West Indies, being the best prepared, and obtained in a similar manner to the aloes of the East.

Hepatic or *Barbadoes Aloes.*—This variety comes chiefly from the West Indies, but is also brought from ports in East India, especially Bombay. In Barbadoes and Jamaica the aloe plant is largely cultivated on the poorer soils. This extract of aloe is said to be obtained by expressing the juice, boiling it to a proper consistence, or by first making a decoction of the plant, then evaporating, and when the liquid is thick enough, pouring it into calabashes, in which it hardens. These calabashes are large, and weigh, when full of aloes, from fifty to eighty pounds. This variety of aloes, mostly known as Barbadoes aloes, is of a deep reddish-brown colour, but darker, and less glossy. The word hepatic is given to it, from its supposed resemblance to the liver. It has not the aromatic odour of the Socotrine, and is often very unpleasant; the taste is nauseous and intensely bitter; the fracture is not sharp, and the edges are not translucent. The powder is of a dull olive yellow colour. There is a fourth variety rarely met with, named the *caballine, fetid,* or *horse aloes.* It is very impure, and is supposed to be procured from the dregs of the better varieties. It is chiefly given to horses.

General Properties.—The taste of all the aloes is very bitter and permanent. Several chemists have analyzed this drug, and find it to consist of bitter extractive, resin, and in some varieties, albumen. The proportion varies in different specimens; the bitter extractive is the *resino-amer* of Braconnot, the resin he designated the *flea-coloured principle.* The chief difference between the Socotrine and Barbadoes aloes consists in this: in the former there is a larger portion of extractive matter, and consequently less resin; and in the latter we find from five to twelve per cent. of albumen. Aloes yields its active matter to cold water, and when good is almost entirely soluble in hot water; the resinous portion subsides as the liquid cools. It is also soluble in diluted spirit, sp. gr. ·950. Long boiling impairs its activity, by converting the extractive into insoluble *apothéme* of Berzelius. The alkalies, in some degree, alter its properties, and render it easier of solution.

Medical Properties.—Aloes is tonic, purgative, and emmenagogue. In small doses it improves the secretions and tone of the stomach in cases of dyspepsia, and for this object is best administered in the form of the compound decoction. As a purgative, it is warm, stimulating and tonic; especially indicated in persons of sedentary habits, and of lax, weakly fibre. In purgative doses it is first supposed to stimulate the gall-ducts, causing an increased flow of bile; it has little action on the small intestines; when it arrives at the colon it promotes muscular action, which is propagated to the rectum, and bulky solid motions ensue. If it be given in larger doses, it may be said to act as a drastic. In ordinary cases, it operates upon the muscular coat of the intestines. An objection to aloes, as a purgative, is the tendency to produce hæmorrhoids, an opinion laughed at by some as absurd, and as so far from correct, that they consider aloes a most efficacious remedy in hæmorrhoids. From my own experience, I should say, that aloes most decidedly will cause hæmorrhoids in the greater number of persons, if it be taken in repeated doses for some days; and I know some individuals, in whom a single dose of aloes is sure to bring on that disorder. As an emmenagogue, aloes is very useful, especially when combined with the preparations of iron. Its operation, in this way, is supposed by many to depend chiefly upon its purgative qualities, producing merely by sympathetic excitement, increased vigour in the uterine vessels. It is probable that aloes has some specific emmenagogue quality, for it acts even best when the purgative action is little experienced.

As aloes stimulates, and determines so much to the lower parts of the abdominal and pelvic viscera, it should not be used in some particular cases, such as early periods of pregnancy, menorrhagia, hæmorrhoids, fistula in ano, or in inflammatory affections in general. There are other purgatives which seem to act most upon the upper part of the intestinal canal, and therefore are combined advantageously with aloes. They modify the action of each other, and combined, produce an excellent effect: such is gamboge, &c.

A solution of aloes forms an excellent enema in cases of ascarides.

Dose.—As a tonic, gr. j to gr. iij.
Purgative, gr. iv to gr. x.
Emmenagogue, gr. ij to gr. iv, night and morning.

Prep.—Dec. Aloes c.,—Extr. Aloes Pur.,—Pil. Aloes c.,—Pil. Aloes c. Myrrhâ,—Pil. Sagap. c.,—Pulv. Aloes c.,—Tinct. Aloes,—Tinct. Aloes c.,—Vinum Aloes,—Pil. Camb. c.,—Pil. Col. c.,—Pil. Aloes cum Sapone,—Pil. Rhei c.

ALTHÆÆ FOLIA ET RADIX.

The leaves and root of ALTHÆA OFFICINALIS. *Common marsh-mallow.*

This plant is indigenous, and grows likewise in most European countries. It is generally found by the sides of rivers and other moist places. The whole plant abounds in mucilage. The leaves and root are officinal.

The roots are collected in autumn, from plants at least two years old. They vary in size; in England the younger roots, that is, of one year's growth, are often gathered. In Germany they are generally of the thickness of the finger, and the epidermis having been removed, the root has a very white appearance.

These roots contain a large quantity of mucilage, and besides starch, saccharine matter, and a crystallizable substance, considered to be asparagin. This, however, is believed by some chemists not to exist ready formed in the root, but is a product of the changes which it undergoes by the action of the water. The root becomes somewhat acrid by decoction, possibly from the formation of aspartic acid.

Medical Properties.—Demulcent, used in the form of decoction, to allay irritation in the alimentary canal, and urinary passages, taken freely as a drink. The leaves are sometimes employed as an external application to bruised parts, or to ulcers.

Dose.—Ad libitum.

Prep.—Syrupus Althææ.

ALUMEN.

Alum is a compound salt, occasionally found ready formed, but generally prepared artificially from the alum ores or earths.

In the neighbourhood of Naples it is a natural product, and is collected from the surface of the ground on which it effloresces, and afterwards is cleaned and purified.

In this country alum is procured from schistose pyritic clays, consisting of alumina and sulphuret of iron. By exposing the mass to air and moisture, sulphuric acid is formed and the iron is oxidized; and the acid, with the bases, forms a sulphate of iron and sulphate of alumina. These are removed from impurities by lixiviation. The liquid is then heated to evaporate a portion of the water, when the sulphate of iron crystallizes first and may be removed; to the solution of sulphate of alumina sulphate of potash is added, heat is applied, and the solution is then set by to cool, that the alum may crystallize. It is further purified by repeated solution, if necessary. The crystal of alum is an octohedron.

Several other processes are employed in different countries.

In addition to the alum prepared in our country, we meet with *Roche* alum, so named from being brought originally from Rocca, in Syria; it occurs in small fragments, covered with an efflorescence of a pale rose colour. Similar to this is another variety, named *Roman;* the redness of its surface depends upon oxide of iron.

Most alums, of commerce, contain some sulphate of iron, varying from five to seven parts in a thousand. This can be detected by the usual tests for iron.

CRYSTALLIZED ALUM is composed of,

1	sulphate of potash		= 88
2	sesquisulphate of alumina		= 172
24	water	24×9	= 216
			476

Formula $KO, SO^3 + Al^2, O^3, 3\,SO^3 + 24\,HO$.

Medical Properties.—Astringent and styptic, both internally and externally. It is most frequently given in hæmatemesis, and less frequently in hæmoptysis, and uterine hæmorrhage. In such cases it may be given in doses of ten grains to twenty, every third or fourth hour. It acts by constringing the minute vessels, and in addition appears to have a sedative effect on the circulation. It is also useful as a gargle in ordinary sore throats, and has been found a useful remedy in the treatment of colica pictonum. In this disease, contrary to expectation, alum seems to act as an aperient, given in doses of ℈j to ℥ss. Its good effects have been thought to arise from the sulphuric acid decomposing carbonate of lead in the intestines forming an inert sulphate of lead. This is not very probable, as the disease often shows itself long after exposure to lead in any form, and in cases where no carbonate of lead can have found its way into the alimentary canal. Possibly it may act by giving sufficient contractility and tone to the muscular apparatus of the intestines, which was previously in a somewhat paralysed state.

Alum is useful in collyria, in injections for gleet or leucorrhœa; dissolved in a decoction of oak bark, is a favorite form for it. Should acetate of lead be taken in large doses by accident, alum would supply a very good antidote.

For collyria, three or four grains to an ounce of water are sufficient. For injections, twice or thrice the quantity may be used.

A nice cooling application for the eye, in ophthalmia, named alum curd, may be made by stirring up a lump of alum in the white of an egg, then placing it in soft linen, and applying it upon the eye, and allowing it to remain for some hours.

Some make an alum whey, by boiling two drachms of alum in a pint of milk, then straining it, and give about half an ounce for a dose in diseases which are benefited by the use of alum.

The pulvis aluminis compositus of some Pharmacopœias is a very good styptic application to bleeding vessels.

Prep.—Liq. Aluminis Comp.

AMMONIACUM.

A concrete juice obtained from the DOREMA AMMONIACUM.

This plant is umbelliferous, and of a very large size, growing to a height of seven or eight feet: it grows spontaneously in several provinces of Persia, and in some parts of Arabia. At a certain period of its growth, the plant is said to be attacked by insects of the beetle kind, which pierce it in many places, and from these punctures the ammoniacum runs out and concretes in tears.

Ammoniacum is brought over in masses, or in distinct tears. The latter form is the best. It is partly soluble in water, alcohol, ether, vinegar, more completely in volatile oils or ammoniated alcohol. Triturated with water, it forms a milky emulsion.

From 100 parts, Bucholz obtained—

Gum	22·4
Resin	72·
Bassorin	1·6
Volatile oil, including loss and water	4·

Medical Properties.—Stimulating expectorant, possibly antispasmodic, and emmenagogue. It may occasionally become diaphoretic, diuretic, or purgative. The cases most likely to be benefited by it are chronic catarrh, chronic bronchitis, and asthma, in which there is more expectoration than is beneficial, and which depends upon debility of the excreting vessels. The ammoniacum then appears to give them tone, and gradually diminishes the quantity of fluid. It seldom succeeds in establishing a discharge of mucus from the air passages by its own unaided operation. In the above diseases it is generally associated with the vinegar or tincture of squills, and is given in the form of Mistura Ammoniaci.

Ammoniacum is also considered to be rubefacient, discutient, and resolvent. For this purpose it is introduced into the Emplastrum Ammoniaci, and Empl. Ammoniaci cum Hydrargyro.

Modus operandi, as an Expectorant.—Its action, as an expectorant, is not agreed upon. It may operate, by its stimulant effect, on the body generally; or by getting into the blood, and coming in contact with the bronchial vessels, and exciting them to healthier action; or, thirdly, by sympathy with the stomach, and for this reason, the stomach and lungs being chiefly supplied by the same nerve, it is highly probable that any impression made on the nerves and vessels of the stomach will, by sympathy, be felt in a similar manner by the nerves and vessels of the bronchial tubes. In like manner we attempt to explain the action of squills and other stimulating expectorants.

Dose.—Gr. x to gr. xx, in pills.
Of the Mist. Ammoniaci, ℥ss to ℥jss.

Prep.—Empl. Ammoniac.,—Empl. Ammoniac., c. Hydrarg.,—Mist. Ammoniaci,—Pil. Scillæ Comp.

AMMONIÆ HYDROCHLORAS.

Hydrochlorate of Ammonia, also named Muriate of Ammonia, Sal Ammoniac.

This salt was originally brought from Egypt, having been procured from the soot of camels' dung, which is there used as fuel. It is not imported from thence at the present time.

Now it is made abundantly in England from refuse of animal matter, soot, or gas liquors. By destructive distillation of animal matter, such as pieces of horn, hoofs, &c. a large quantity of carbonate of ammonia is generated, and condenses in the apparatus. This is collected and mixed with water and sulphate of lime; an exchange of acids takes place, and we have sulphate of ammonia in solution, and carbonate of lime at the bottom. This solution is then removed and treated with common salt, and the products are sulphate of soda and hydrochlorate of ammonia, the latter of which is separated by sublimation.

In a somewhat similar manner, this salt is procured from gas liquors, which absorb from the gas sulphite and carbonate of ammonia. A sulphate of ammonia is procured by adding to the liquid sulphuric acid, or sulphate of lime, and the rest of the process is like the former.

By lixiviating soot, the same carbonate and sulphite of ammonia are procured.

Hydrochlorate of ammonia is soluble in three times its weight of cold water, and in its own weight of boiling water, causing much cold during its solution. By high temperature it is volatilized.

Composition :

1 hydrochloric acid = 37
1 ammonia = 17

Atomic number . . 54

Symb. $NH^3 ClH$, or, NH^4, Cl.

It slightly reddens litmus paper; affords no precipitate with the chloride of barium, showing the absence of sulphuric acid. When potash or lime is added to its solution, ammonia is disengaged.

Medical Properties.—It is scarcely ever prescribed for internal use, in this country, although often employed as an external application. In Germany it is considered to be an irritating stimulant and alterative, and to have the power of improving the secretions of glandular organs, mucous and serous membranes. It is given there in catarrhal and rheumatic fevers, pneumonia, bronchitis, and other inflammations after their violence is abated.

It is used externally to produce cold, in the form of lotions, in the quantity of half an ounce to an ounce in ten ounces of water, with the addition of an ounce of rectified spirit. It is likewise supposed to act locally as a stimulant, and with this object is applied to indolent tumours, chilblains, gangrenous parts, &c.

Dose.—Gr. v to gr. xx.

Prep.—Ammoniæ Sesquicarbonas,—Liquor Ammoniæ, —Sp. Ammoniæ,—Sp. Ammoniæ Aromaticus, et Fœtidus.

LIQUOR AMMONIÆ. (*Vide* Decompositions.)

AMMONIÆ SESQUICARBONAS. (*Vide* Decompositions.)

AMYGDALA AMARA ET DULCIS.

The Kernel of the AMYGDALUS COMMUNIS, of which one variety affords the Bitter, another the Sweet Almonds.

The tree which bears them is a native of Persia and Africa, now extensively cultivated in the South of Europe, especially Spain. The almond tree grows to a height of een to twenty feet; its fruit is of the peach kind, con- ning within it the kernel or almond. Each kernel isists of two white cotyledons, enclosed in a thin lowish brown bitter skin, which is easily separated after nersion in boiling water. The sweet and bitter almonds obtained from varieties of the same species of tree.

weet almonds are imported from several places, and variously designated in the markets as Valencia, bary, Jordan, &c. Bouillay analyzed them, and found 00 parts,

Pellicle	5
Fixed oil	54
Emulsin	24
Sugar, uncrystallizable	6
Gum	3
Fibrous matter	4
Water	3·5
Acetic acid and loss	0·5
	100

'he fixed oil, obtained by expression, is of a yellow ur and bland, and agreeable to the taste. Almonds, rated with water, form a milky liquid, called almond ilsion, the insoluble matter being suspended by the and saccharine matter.

itter almonds are generally smaller than the sweet, and ier flatter. They have a taste like peach kernels, and, igh inodorous in their natural state, when triturated water, they have the fragrance of the peach blossom. y contain a fixed oil, which they yield by pressure, and ch resembles that from the other variety; from the due, by distillation in water, we procure a volatile oil hydrocyanic acid. This oil and acid do not seem to t ready formed in the almond, but to be educts of the illation in water: that cyanogen is present, may be wn by forming bicyanide of mercury, when the peroxide hat metal is added. The volatile oil deposits, after a e time, some benzoic acid, which appears to be formed he action of the air. The azotized substance that is umed to afford the oil and acid just mentioned, has named by chemists Amygdalin. It is considered to de also in the cherry-laurel, bird-cherry, and other vegetables which have the reputation of containing hydrocyanic acid.

Medical Properties.—Sweet almonds are used commonly in the form of emulsion, as a demulcent in coughs, irritation of the bowels or urinary passage. This emulsion is also used as a vehicle for other substances, as gum resins or balsams. The fixed oil will form a milky liquid, with a little liquor potassæ and distilled water, and is frequently employed as a substitute for the mistura amygdalæ. The oil also enters into the composition of some ointments.

The oil of bitter almonds has been given in cases which are benefited by the use of hydrocyanic acid, and some give it preference to the acid, as it is easily preserved for several years, and remains of uniform strength. It is chiefly prescribed to allay coughs, and tranquillise the system generally. As it is very potent, it requires to be administered with great caution.

Dose.—Of the Mistura Amygdalæ, ad libitum.
Of the Essential Oil of Bitter Almonds, $\frac{1}{4}$ minim to 2 minims.

Prep.—Confect. Amygdalæ,—Mistura Amygdalæ,—Oleum Amygdalarum.

AMYLUM.

Starch, a fæcula, from the seeds of the TRITICUM VULGARE.—*Common Wheat.*

Starch is contained in many seeds, especially of the natural order Graminaceæ; also in peas, beans, chesnuts, acorns, and in the tubers of some plants, as the potato, in the arrow-root plant, and very many others.

It is procured in several ways. From wheat, it may be obtained by steeping the wheat to soften it; then squeezing out the soft substance into water: the gluten undergoes decomposition whilst the starch remains, which, by evaporation of the water, is procured in a solid form. On a small scale it may be procured by putting into some linen a portion of wheat flour, and let water run over it; in passing, the water will mechanically dislodge the starch, and the gluten will remain behind; the turbid liquid being collected and allowed to stand, the starch gradually subsides.

Starch is insoluble in cold water, ether, and alcohol. It unites with boiling water, and forms a thick paste, which may be considered to be a hydrate of starch. Subacetate of lead precipitates it, and iodine forms with it a beautiful blue colour, and is a most delicate test of its presence.

Starch is the basis, and indeed the sole principle in many substances employed to convey nourishment in a mild form, such as arrow-root, sago, and tapioca.

Composition of starch, in 100 parts, according to Berzelius:

Hydrogen . . .	6·674
Carbon . . .	44·250
Oxygen . . .	49·076

Formula $C^{24} H^{20}, O^{20}$. (Fownes.)

Medical Properties.—Nutritive and demulcent. It is seldom given as a medicine. The most frequent use of it is as an emollient enema, to allay irritation in the rectum, and of the bladder by contiguity, and as a vehicle for other substances. The powder of it is sometimes sprinkled over ulcers and excoriations, to absorb acrid secretions.

Prep.—Pulv. Tragacanthæ Comp.

ANETHUM.

The Fruit or Seeds of the ANETHUM GRAVEOLENS.—*Dill.*

This is an annual plant, a native of Spain, Portugal, and the South of France, and is cultivated in most European countries. The seeds which are imported are most powerful.

These seeds contain a volatile oil, on which solely their virtues depend. It is of a yellow colour. Sp. gr. ·881. The bruised seeds impart their qualities to alcohol and boiling water.

Medical Properties.—Aromatic, stimulant, and carminative, most frequently given to children to correct griping in the bowels, in the form of Aqua Anethi. Carminatives appear not only to expel flatus, but also to check the extrication of gas, and to render the nervous filaments less sensible to the effects of distension.

Dose.—For an adult, of the bruised seeds, gr. x to gr. xxx. For a child, a teaspoonful or two of the water.

Prep.—Aq. Anethi.

ANISUM.

The Fruit of the Pimpinella Anisum.—*Anise.*

This plant is a native of Egypt, and now abundantly cultivated in the South of Europe. The seeds, called fruit in the Pharmacopœia, are imported from the South of France and Spain.

They have a fragrant odour, which is increased by friction; and a sweetish, warm, aromatic taste. These properties depending on a volatile oil are imparted sparingly to water, but freely to alcohol. This oil exists in the envelope of the seeds. The internal substance contains a bland fixed oil, which may be separated by pressure.

There is another variety of Aniseed occasionally met with, called the Star Aniseed. It is the fruit of the Illicium Anisatum, an evergreen tree, which grows in China, Japan, and Tartary. The volatile oil from it is even superior to that of Common Aniseed, and is much used in France to flavour liqueurs. The oil is imported from the East Indies. This variety is often sold for the other oil of Aniseed, has the property of readily becoming solid at low temperatures, and acquires somewhat a crystalline appearance.

Medical Properties.—Much the same as of the Dill. In addition it is said to increase the secretion of milk, and was formerly a favorite in catarrh and influenza. It is chiefly employed to prevent griping, in the form of Aqua, or Spiritus Anisi.

Dose.—Of the powdered seeds, gr. x to gr. xxx, a teaspoonful or two of the water may be given to infants.

ANTHEMIS.

The Flowers of the Anthemis Nobilis.—*Common Chamomile.*

This plant is indigenous, and is now extensively cultivated for medical use in many parts of England, especially at Mitcham, in Surrey. The single are preferred to the double flowers, as they contain more of the active ingredients; those which are the whitest are best, for they have been more carefully dried than those of a darker colour.

They impart their flavour both to water and alcohol.

Boiling water will extract one fourth of their weight. They have not been carefully analyzed, but are known to contain—

A volatile oil; bitter extractive; resinous matter; some tannin.

To these may be added a crystallizable substance, named Piperine, which is most readily extracted from black pepper. It bears some analogy to a resin, and produces so little sensible effect upon the body, that it requires a stretch of imagination to suppose that it is the active substance of any drug containing it.

Medical Properties.—Tonic, stomachic, and the warm infusion is emetic. It is given in dyspepsia, in chlorosis, and amenorrhœa, to give appetite and improve the general health. The infusion is a very good vehicle for some salts. The extract, in the same manner, is useful in forming pills, which contain some mineral tonic. The warm infusion may alone occasion vomiting, but is most useful in keeping up and encouraging the vomiting, which may have been induced by more powerful substances. This drug is said to have been found useful in intermittent fevers, and its good effects have been referred by some authors to the Piperine, which is found in it.

Dose.—Of the extract, gr. x to gr. xv.
Of the infusion, 2 to 4 ounces.

Prep.—Extract. Anthemidis,—Infusum Anthemidis,—Oleum Anthemidis.

ANTIMONII TERSULPHURETUM.

Tersulphuret, Sesquisulphuret, or Sulphuret of Antimony.

This substance is obtained from the native sulphuret, which is by far the most abundant form in which Antimony is found. The sulphuret of the shops is obtained from the native ore, by fusing it, to separate impurities. To effect this, the ore is broken to pieces, then put into pots with perforated bottoms, resting upon others; some fuel is applied around them, then ignited, and the melted sulphuret runs into the pots underneath, where it becomes solid.

It is chiefly imported from France, Germany, and Singapore, generally containing a small quantity of lead, iron, or arsenic.

Composition:

3 sulphur = 48
1 antimony = 129
177

In a medical point of view it is of little or no service; some consider it to be alterative and diaphoretic. It is employed pharmaceutically in making Antimonii Oxysulphuretum, Antimonii Potassio-tartras, and Pulvis Antimonii Compositus.

The preparation of Antimony, which is most powerful, and supersedes all the others in its efficiency, is the Potassio-tartrate of Antimony, commonly called Tartar Emetic, which may be procured according to the formula of the 'London Pharmacopœia.'

Medical Properties of Tartar Emetic.—It is expectorant, diaphoretic, purgative, emetic, and sedative. Its general action is relaxing and depressing, therefore it is suited for the treatment of inflammatory diseases, but is injurious to those of an opposite character. If this substance be given in doses of about half a grain repeatedly, we see most of the effects which it produces on the body; it brings on nausea, and attending this we find perspiration, increased secretion from the bronchial tubes, and, indeed, an increased secretion on most other surfaces and organs; the heart, at the same time, beats more feebly; the pulse is weaker, the muscles feel relaxed, and there is a general sense of prostration. These are the symptoms produced by a sedative, and they arise without any previous marked excitement. If the dose be larger there will be free vomiting and purging, followed by excessive prostration, so great as to destroy life in persons much weakened by disease. If the remedy be continued for several days, it will sometimes occasion ulceration of the bowels. This may be accounted for by supposing that tartar emetic destroys the vitality of the tissues in certain parts, and that the ulcerative process is an effort of nature to throw off the dying or dead substance. The same explanation may be given of the effects of tartar emetic on the surface of the body, upon which it will occasion a pustular eruption, very like smallpox. This opinion is somewhat at variance with the notions usually entertained on the subject; in a practical view, it will not interfere with the use generally made of the drug; the object is only to render its operation more intelligible and less contradictory, so that we should look upon it as a sedative, antiphlogistic remedy, directly opposed to inflammatory action; and in no degree view it as a primary stimulant.

The diseases in which it is most decidedly beneficial, are inflammation of the lungs, pleura, bronchial tubes, and croup; it is of great service in most other inflammatory affections, in mania, acute rheumatism, and hydrocephalus. In whatever inflammatory disease it is prescribed we shall find that the higher the inflammation runs, the larger the dose of tartar emetic can be tolerated, and that in proportion as the disease abates, we must also reduce the dose. The maximum dose of it should not exceed from one to two grains every second or third hour. The practice of giving it in Italy, during the last twenty years, in tremendous doses, is very much misrepresented. Tommasini scarcely ever exceeded one-grain doses, Rasori did the same for several years. Unfortunately, translators have repeatedly mistaken the quantity administered in twenty-four hours for a single dose to be frequently repeated.

In inflammatory diseases it acts beneficially by lowering the pulse, relaxing the exhalants and capillaries, determining blood to other parts, and equallising the circulation. It action is almost equal to that of Calomel, in arresting the secretion of lymph; and it is also thought that when nausea is induced, absorption is carried on more vigorously. In consequence of its relaxing effect, it is often employed to assist the efforts to reduce dislocations.

As an expectorant, it should be given in inflammatory diseases, and acts by relaxing the exhalant vessels, causing them to throw out more fluid and of a thinner character. For this purpose, doses of ⅛th of a grain are sufficient, to be frequently repeated.

The dose, as a diaphoretic, should be a quarter to half a grain, repeated three or four times a day. As a purgative, tartar emetic seldom operates much alone, although it powerfully increases the action of other purgatives, particularly sulphate of magnesia, jalap, &c. The dose for this object, is half a grain. As an emetic, the dose is from one to three grains, best administered with some pulvis ipecacuanhæ. It should be recollected that this is a nauseating, depressing emetic, well fitted for the commencement of fevers, and ill suited in cases of poisoning, as by opium, other vegetable narcotics, or mineral substances. In poisoning, it is objectionable, because it acts slowly, it induces nausea, and with that nausea the poison appears to be more rapidly absorbed, and after the operation of the emetic, too much prostration ensues.

Externally, it is applied to the body to produce a pustular eruption, which will show itself in two or three days. In this way it is viewed as a counter-irritant, and is employed in the treatment of deep-seated chronic and painful affections, such as chronic bronchitis or pleuritis, hooping-cough, chronic hepatitis, pains about the joints, and many others. Care should be taken not to apply it to persons much emaciated and reduced by disease, for in such it is likely to cause sloughing.

It is used externally in the form of ointment or liniments, or sprinkled upon plasters, to the surface of which it is made to adhere whilst still warm. The quantity of the salt to an ounce of lard, or common ointment, may be one to two drachms.

Poisonous Effects.—In very large doses tartar emetic may prove fatal; the symptoms occasioned by it are, an austere metallic taste, nausea, pain at the stomach, vomiting, fainting, frequent stools, colicky pains in the bowels, a small contracted pulse, clammy skin, changing from hot to cold, difficult respiration, convulsions, cramps in the legs, prostration, and even death may ensue. Vomiting and purging do not always come on, for the poison may so depress the powers of the stomach as to render it insensible to impressions. The treatment consists in promoting, or encouraging vomiting, and giving vegetable substances, which contain tannin, to decompose the poison, and render it inert. Oak-bark, which contains much tannin, does not, however, decompose this substance. To check excessive vomiting and purging, opium and demulcents should be given; and afterwards, antiphlogistic medicines, to combat the reactive inflammatory action which follows.

There are many tests for antimonial salts; the most important are hydrosulphuric acid, or the hydrosulphates, which will throw down an orange-red precipitate, and thus will distinguish antimony from all other metals which we re likely to meet with.

Prep.—Vin. Ant. Potassio-tartratis.
Ung. Ant. Potassio-tartratis.

ARGENTUM.

Silver.—This metal is found rather sparingly in a pure tate, more abundantly in the form of a sulphuret, or ombined with other metals, as arsenic, antimony, mercury, ead, copper, and occasionally as a chloride. The ore, hich affords the greatest supply, is the sulphuret, mixed n our country with the sulphuret of lead; and the name given to it is, Argentiferous Galena. The most productive ines are in Mexico and Peru; the richest in Europe are hose in Norway, Hungary, and Transylvania. About one welfth of the silver annually extracted from the earth is btained in Europe.

The processes by which silver is procured from its ores, re cupellation and amalgamation. At Freiburg, in Saxony, he ore, chiefly the sulphuret, is mixed with chloride of odium, and then roasted. By the heat, the sulphur and odium are oxidized, and sulphate of soda and chloride of ilver are formed; the roasted mass is then powdered and ixed with mercury, some water and some iron in flat ieces, and submitted to agitation in barrels for several ours. The consequence of this is, the chlorine combines ith the iron, forming a soluble chloride, and the silver orms an amalgam with mercury. This is then pressed in eathern bags to express any excess of mercury; then is ubjected to distillation, by which the mercury is volatilized, nd pure silver remains.

Silver is procured from argentiferous galena, simply by he action of heat and air; the lead melts, remains on the urface, and is gradually removed in the form of oxide; the ilver, not being oxidizable, remains.

Silver does not oxidize when exposed to the air, but is soon tarnished by the contact of sulphur, which unites with and gives it a brownish-black appearance. It combines, by chemical means, with oxygen, in three proportions; the basic oxide consisting of

1 silver = 108
1 oxygen = 8
Atomic number . . 116

It has a dark brown colour, and in pharmacy enters into the composition of nitrate of silver.

NITRATE OF SILVER is conveniently prepared in the following manner.

Ingredients:

Silver,
Nitric Acid,
Distilled Water.

Decomposition.—A portion of nitric acid is decomposed, and converted into oxygen and binoxide of nitrogen; the oxygen combines with the silver to form oxide of silver, with which the undecomposed acid unites, to form nitrate of silver; the binoxide of nitrogen escapes, and, with oxygen of the air, forms nitrous acid fumes. The solution is then heated, to drive off the water and any excess of nitric acid.

Qualities.—It is white, but turns dark by exposure to light. It is quite soluble in water. The solution yields a precipitate of silver, if copper be put into it.

Composition:

1 nitric acid = 54
1 oxide of silver = 116
170

Formula $Ag\,O, NO^5$.

It is an anhydrous salt, as usually employed by surgeons.

Medical Properties of Nitrate of Silver.—Tonic and antispasmodic. It is given in the treatment of chorea, epilepsy, angina pectoris, some forms of dyspepsia, and some spasmodic affections. It requires to be administered cautiously, in consequence of its active nature; but generally, its use must be continued for some time to produce its good effects. It is best given in the form of pill, which should be made by first reducing the nitrate to a fine powder, then making it into a mass by some conserve, or thick mucilage; for the bread crum, usually employed, is objectionable, on account of some common salt existing in it. When it is taken internally, common salt in its various compounds should be avoided, as it effectually destroys the action of the nitrate, by the chlorine forming with the silver an insoluble chloride. This being the case, it is not improbable that in the instances mentioned of persons taking twenty grains for a dose, either that some salt had been taken a short time before, or that the stomach secreted an unusual proportion of hydrochloric acid. An objection to the long administration of this salt is, that the surface of the body is liable to be discoloured, assuming an unhealthy livid, bluish appearance, somewhat resembling the morbus cæruleus. The theory of its occurrence is, that nitrate of silver is decomposed in the blood, by meeting with hydrochloric acid, and that chloride of silver is formed; that this is deposited in the rete mucosum, and by the exposure to light assumes a dark colour. Some say that the chloride is formed in the alimentary canal. To produce the dark colour, this chloride must be decomposed, and converted into a sub-chloride or metallic silver. To prevent this discoloration, it is suggested to keep the patient, whilst taking the nitrate, in a darkened room, to administer an excess of nitric acid to prevent the rapid decomposition of the salt, and when discoloration has shown itself, to have recourse to a steady course of cream-of-tartar. There is very little to support either of the above recommendations; whoever takes this medicine should be warned of the possible consequence, which, in a female in particular, may be destructive to her happiness.

The *oxide of silver* has been highly recommended by Sir James Eyre and others, as an internal remedy, in preference to the nitrate, in the same diseases, but more especially in diseases of the uterus, attended with laxity and abnormal discharges. It may be given in rather larger doses than the nitrate, and is much less prone to discolour the skin.

Externally, nitrate of silver is used for several purposes as a stimulant, or escharotic. It is employed as a wash for the mouth, in ulcerations or salivation from mercury; in aphthæ or spongy gums; to stimulate indolent ulcers; as an injection in fistulous sores, in leucorrhœa or gonorrhœa. A weak solution of it is a good application in ophthalmia to remove specks on the cornea, and to drop into the external meatus of the ear, in case of copious discharge from it. As an escharotic, a drachm may be dissolved in an ounce of distilled water, and applied by a camel's hair pencil; or the solid nitrate may be used for warts, fungous excrescences, incipient chancres, and to destroy the surface of unhealthy ulcers.

If nitrate of silver be taken accidentally in a very large dose, it will act as a powerful corrosive poison. The antidote for it is common salt, which should be given freely, to form an inert insoluble chloride; then demulcents may be administered, and subsequently antiphlogistics, to combat the inflammatory symptoms which may follow.

The tests for this substance in solution are the following:

It stains the body or substances generally.

A soluble chloride or hydrochloric acid produces a white precipitate, the chloride of silver, insoluble in nitric acid, soluble in ammonia, and which turns dark by exposure to light.

Hydrocyanic acid throws down a white cyanide of silver insoluble in cold nitric acid, soluble in ammonia, and by heat is decomposed: cyanogen gas escapes, and the metallic silver remains.

Oxalic acid occasions a white precipitate of the oxalate of silver, which, when dried and heated, fulminates violently.

Hydrosulphuric acid affords a black sulphuret of silver, which, by reduction, leaves metallic silver, to be recognised by its light brilliant appearance, its softness and ductility, and not being oxidized by the action of the blow-pipe.

There are many other tests, but the above are amply sufficient.

Dose.—Gr. ⅛, gradually increased to two or three grains, three times a day.

For external use.—As a mouth wash, 1 grain to an ounce of water.

n injection, from 1 to 5 grains to an ounce of water
: used according to its sensible effects.
phthalmia.—One to two grains in an ounce of water
ally sufficient, but if the disease has the purulent
ı stronger solution may be dropped in, with as
s 5 grains, and, according to some, 10 grains in an
ıf water.
.—Liq. Argenti Nitr.,—Argenti Cyanidum.

ARMORACIA.

fresh root of COLCHLEARIA ARMORACIA.—*Horse*
.

plant is a native of Western Europe, and now
ıo freely in this country as to make it considered by
› be indigenous. The root is perennial, and is the
ırt of the plant which is officinal. When scraped or
it has a strong pungent odour, and a powerfully
ing taste; it imparts its qualities to water and
. Its properties depend on a volatile oily principle,
s lost by drying, and the root becomes compara-
nert. It also loses its acrimony by boiling in water.
may be procured separate by distillation. It is of
yellow colour, heavier than water, and has the pro-
of the root in a concentrated form. In addition to
nciple, chemists have found in the root—

le bitter resin; sugar; extractive; gum; starch; albumen;
id; acetate and sulphate of lime; lignin; water.

ical Properties.—Stimulant, not only to the stomach,
many of the secretions, and rubefacient externally.
be used in dyspepsia, in old gouty people, when
mach requires a stimulus. It is thought to act as a
:, and to be a purifier of the blood, and with this
taken as a condiment by many. The infusion or
e may be prescribed in low states of the system, as
ral stimulant. The recent root scraped and ap-
o the skin is rubefacient, and sometimes occasions
on.
.—Of the scraped root, gr. xx to gr. xxx.
Of the Inf. Armoraciæ Comp., ʒiss.
Of the Spirit, ʒj to ʒij.
.—Inf. Arm. Comp.,—Sp. Arm. C.

ASARUM.

The leaves of Asarum Europæum.—*Asarabacca.*

This plant is indigenous, and likewise found in most European countries. It has a perennial root, and sends up annually leaves, which are usually only two in number, and are kidney-shaped. The leaves are officinal with us. On the Continent the root also is used. The leaves are almost inodorous, but have a somewhat aromatic, bitter, acrid taste, affording a yellowish-green powder. They lose their virtues by keeping. Their virtues are imparted to water and alcohol; but are lost by boiling. According to Feneuille and Lassaigne they contain—

A volatile oil; an acrid fixed oil; a yellow substance resembling cytisin; starch; albumen; mucilage; citric acid; some saline substances.

Medical Properties.—This plant is cathartic and emetic; but as it irritates considerably during its operation, its employment is discontinued for such purposes. The only use now made of it is an errhine, and that very seldom. Two or three grains may be snuffed up the nose, and will produce much sneezing, and a discharge of mucus, which continues for some days. This may be practised in chronic ophthalmia, headaches, and neuralgic pains about the face.

Dose, as a purgative and emetic, ℈j, to ʒj.

Prep.—Pulv. Asari. Compositus. Dubl.

ASPIDIUM.

The root of the Aspidium Filix Mas, now more commonly named Nephrodium Filix Mas. *Male Fern.*

This is an indigenous perennial plant, common in all parts of England, and in most temperate climates. The root of it is officinal. It should be collected during the summer, being most active at that period. It is deteriorated by keeping; so much so, some assert, that it is quite inert after being preserved for two years. It has a feeble odour, and a sweetish, bitter, astringent, rather nauseous taste. Mr. Morin, on analysis, found it to contain—

A volatile oil; fixed oil; gallic and acetic acids; uncrystallizable ır; tannin; starch; gelatinous matter, insoluble in water and hol; lignin; some earthy and saline substances.

Mr. Peschier found it in adipocire, an aromatic volatile l fixed oil, brown resin, a green colouring principle, ractive, acetic acid, and muriate of potash. The active ıciple is soluble in ether.

Medical Properties.—Possibly tonic and astringent, efly employed as an anthelmintic. For the latter pose it is spoken of by most of the ancient authors, obtained great celebrity about sixty years ago, in the ctice of a Madame Nouffer, at Paris. She successfully ıted worm cases, and was paid very extravagantly by ernment to divulge her secret remedy. This was the ıidium Filix Mas. Since that period it has lost its high racter, possibly from the negligence in the mode of ecting and preparing it. It has been most effectual the removal of tape-worm, which it has the power of troying somewhat like the bark of the pomegranate t. It may be given in substance night and morning, loses of one to three drachms. Some imagine that it merely a mechanical action, to which opinion I cannot rely subscribe. An ethereal extract has been made n the root, and given in doses of from 15 to 30 grains. s is reported to be the most effectual mode of using and if the evidence of many most respectable men can lepended upon, it is still deserving of a trial, since the ıedy we most use, the Oleum Terebinthinæ, is particularly ıleasant to our patients, and is sometimes dangerous, occasionally fatal in its operation. Whilst taking a rse of this drug, it would be well to give a brisk gative every third morning.

ASSAFŒTIDA.

The gum-resin of the NARTHEX ASSAFŒTIDA, or FERULA ıAFŒTIDA.

This plant is a native of Persia, from which country we ain our supply of the drug. Its root is perennial, and ıins a considerable size, as much as four or five inches liameter; annually it sends up numerous leaves, and a n which is often two inches in thickness, and eight or e feet high. To obtain the assafœtida, the stem is cut off at its junction with the root, and from this surface the gum-resin exudes, and is scraped; another slice is then removed to allow further exudation, and this process is repeated till the root is exhausted. The substance is then mixed up in large quantities, and by keeping, acquires considerable hardness. It comes over in large masses in mats, cases, or casks, and occasionally is met with in the form of tears, as if it had exuded from numerous punctures on the plant. Its odour characterises this drug; it is said to be infinitely more powerful when first collected, and gradually becomes fainter, so that, if exposed to the air, the smell of it is ultimately imperceptible. It is also known by a singular property of changing its colour. If a piece be broken it has a whitish appearance; but in a few hours turns to a beautiful pink: in a day or two this goes off, and the surface turns to a yellowish brown. A similar change is observed if assafœtida be triturated with water and allowed to stand. It yields its virtues entirely to alcohol, and forms a transparent yellowish solution. With water it forms a milky solution, owing to the suspension of the resin, which is undissolved. It has been analysed by Pelletier and Brandes. The former found it to contain in 100 parts—

Resin	65
Gum	19·44
Bassorin	11·66
Volatile oil, with traces of supermalate of lime .	3·60

The analysis of Brandes gives a vast number of other unimportant constituents. The oil and the resin are the active principles.

Medical Properties.—Assafœtida is a stimulant, expectorant, antispasmodic, in a less certain degree anthelmintic and emmenagogue. It is also somewhat laxative; not fitted for diseases where there is active inflammation, but well adapted for chronic affections in which the nervous system requires a stimulus. It is consequently beneficial in chronic catarrh, bronchitis, and asthma; in hysteria; in dyspepsia of old people, accompanied with borborygmi; in spasms of the bowels; in flatulent convulsions of children; in hooping-cough, where there is debility without evident inflammation: it is used likewise as an injection in typhoid fevers and nervous apoplexy, to rouse the nervous system.

In Persia it is used as a condiment; and even in this country, by habit, persons acquire a great penchant for it, and rub it upon a hot plate, which is to receive their food. They prefer it far above onions or garlic. The great objection to its use is the horrible fetor, which is perceptible in the breath for many hours afterwards.

Dose.—Gr. v to gr. x, in the form of pill.
Of the Mistura Assafœtidæ, from ʒvj to ℥iss may be taken.
Of the Tincture ʒj to ʒij.
For an injection ʒij may be triturated with warm water.

Prep.—Enema Assafœtidæ,—Mist. Assafœtidæ,—Pil. Galb. Comp.,—Spir. Amm. Fœtidus,—Tinct. Assafœtidæ.

ATROPIA. (*Vide* BELLADONNA.)

AVENA.

The seeds of the AVENA SATIVA. *Common Oat.*

This plant is cultivated in most civilised countries; its original locality is not known. It grows wild in Sicily.

The grain is most extensively used for horses, and is very nourishing. The inhabitants of many countries consume it largely, as in Scotland and the north of Ireland. Deprived of the husk, the seeds are called groats or grits, and are generally kept in a bruised state. When reduced to powder they form oatmeal.

According to Payen, oats contain in 100 parts—

Starch	60·59
Gluten and other azotized substances	14·39
Dextrine and glucose	9·25
Fatty matters	5·50
Cellulose	7·02
Salts of lime, magnesia, soda and potash	3·25
	100

It has little odour, is slightly bitter, and yields most of its nutritive matter to boiling water. The liquid so prepared is called gruel. It affords nourishment in a very mild form, is at the same time demulcent, and has a slight laxative action. It is a nice drink taken after purgatives, to assist their operation, and is an excellent vehicle for enemata and other substances. Gruel may be made by boiling one ounce of the oatmeal in three pints of water down to two, then straining it, and flavouring it with sugar, salt, lemon juice, or raisins, according to the taste of the patient.

AURANTIUM.

AURANTII CORTEX.—AURANTII FLORES.—AURANTII OLEUM. Flowers and oil of the flowers, and the fruit of the CITRUS AURANTIUM, and the peel of the fruit of the CITRUS BIGARADIA.

The orange tree is a native of warm climates, most probably India and China. It now grows freely in the South of Europe, from whence our supplies are chiefly derived. The orange may be distinguished from the lemon tree by the petioles which are winged in the former, naked in the latter; and also by the character of the fruit. It is the Citrus Aurantium which affords the oranges so commonly used at table. Many parts of this variety of orange are employed. The fresh flowers, distilled with water, afford a fragrant perfume, which is considered by some to be also antispasmodic. An oil is distilled from the flowers, named in France Oleum Neroli, which is one of the ingredients of Eau de Cologne. Small, unripe, abortive oranges, previously dried, are kept under the name of orange berries, and after turning in a lathe are used in issues, as a substitute for common peas, to which they are preferred, on account of their pleasant odour. They also afford a fragrant volatile oil, which is much used in perfumery. Orange flower water is now made officinal. It is imported in metallic vessels, usually of copper, and is used in perfumery, and may be employed as an elegant adjunct to collyria. In France and Italy it is taken as an antispasmodic in doses of ℥j to ℥ij. The juice of the common orange contains some citric and malic acids, some acid citrate of lime, mucilage, albumen, sugar and water. For medical purposes the rind of the fruit of the Citrus Bigaradia, Seville orange, is commonly employed.

Medical Properties.—It is a mild tonic, and at the same time has an aromatic flavour. It suits convalescents when they begin to tire of taking medicine. To make it more palatable, some syrup and tincture of orange peel may be added. It is often given with other bitters which are less pleasant to the taste.

Dose.—℥j to ℥ij of the infusion.

Prep.—Inf. Aurantii Comp.,—Inf. Gent. Comp.,—Conf. Aurantii,—Tinct. Aurantii,—Syr. Aurantii,—Tinct. Cinch. Comp.,—Tinct. Gent. Comp.

BALSAMUM PERUVIANUM.

The liquid balsam, procured from uncertain species of MYROSPERMUM.

The tree which has been reputed to yield this balsam, is a native of Peru and New Grenada. The wood is employed in building, and is very durable. By incision the tree yields a balsamic juice, which may be kept in a liquid state for some years, and is named *white liquid balsam*. When this is deposited in mats or calabashes, it concretes, and is called dry white balsam, or *Balsam of Tolu*. By boiling the bark in water, a blackish liquid is procured, named *Peruvian Balsam*. It is also said to be obtained by boiling the twigs in water.

Peruvian balsam is a viscid liquid, of a deep reddish-brown colour, possessing a fragrant odour, a warm taste, and causing a sense of burning in the throat. Alcohol dissolves it entirely.

From 1000 parts Stolze procured—

Brown sparingly soluble resin	24
Easily soluble resin	207
A peculiar oil (cinnamin)	690
Benzoic acid (cinnamonic)	64
Extractive matter	6
Some water.	

Medical Properties.—Tonic and stimulating expectorant. It is likely to be of most service in chronic inflammations of mucous membranes, such as chronic catarrh or bronchitis, gleet, leucorrhœa, and is said to be useful in amenorrhœa, chronic rheumatism, and palsy. It is a mild stimulant to ulcers, and, for this purpose, is mixed with some mild ointment. The best way to administer it is to rub it with mucilage, or the yolk of an egg, before water is added to it.

Dose.—Gr. x to ℈j.

BALSAMUM TOLUTANUM.

The concrete juice of the MYROSPERMUM TOLUIFERUM, or MYROXYLON PERUIFERUM. Its locality is the same as the former, and the mode of procuring it has just been described.

When first imported it has a soft and tenacious consistence; but, by exposure to the air, becomes hard and brittle. It is shining, translucent, and of a reddish-brown colour. When darkest coloured it is least esteemed. Its odour is fragrant; its taste warm, and somewhat pungent; it is entirely soluble in alcohol, and imparts an odour of benzoic acid to water. By distillation with water it affords a small quantity of volatile oil. Tromsdorff found its constituents in 100 parts to be—

Resin	88
Benzoic acid (cinnamonic) . .	12
Volatile oil (cinnamin) . . .	0·2

Medical Properties.—Tolu is a more elegant than useful medicine. Its flavour is agreeable to most persons, on account of which it is employed in the form of syrup, the tincture, or in lozenges. Its real properties are like those of Peruvian Balsam, that is, it is a stimulating expectorant, and anti-spasmodic, unfit for use during the existence of acute inflammatory diathesis. When the tincture is administered, it should be carefully triturated with mucilage, before water is added to it, as it is insoluble in that liquid.

Dose.—Gr. x to gr. xxx.
Of the tincture ʒj to ʒij.

Prep.—Syrupus Tolutanus,—Tinct. Tolut.,—Tinct. Benzoini Comp.

BARYTÆ CARBONAS.

This substance is not used medicinally, and indeed its insolubility would be an obstacle to it. It is employed in pharmacy for preparing the chloride of barium. It is found largely in this country, especially in Lancashire and Cumberland; and also in Sweden. It effervesces when acids are added to it, and is distinguished from other carbonates by its great specific gravity. It is known amongst mineralogists, by the name of Witherite.

BELLADONNA.

The leaves of the ATROPA BELLADONNA. *Deadly Nightshade.*

This plant is indigenous, and is also found in most other European countries. It is readily known by the livid suspicious appearance of its flowers and the character of its leaves, which always come off in pairs, of which one is much larger than the other. The leaves only are officinal. The plant derives its generic name from Atropos, one of the Fates, and its specific name from the Italian language, signifying a beautiful woman. This is said to be owing to its utility as a face pigment, but I should rather suppose from being used to dilate the pupils, a practice still had recourse to by some Parisian women, and which is thought to make them additionally bewitching.

The dried leaves have a dull green colour, a faint narcotic odour, and a sweetish subacrid, rather nauseous taste. Brandes, a German chemist, found in them an alkaloid, which he named Atropia, combined with malic acid; and in addition to this—

Pseudotoxin, with malates of atropia and potash; wax; phytocolla, (a nitrogenized substance); chlorophylle; gum; starch; albumen; lignin; some saline substances.

He procured Atropia by bruising the leaves and digesting them with water, acidulated with sulphuric acid; then filtering and decomposing the sulphate of Atropia with potash, forming a soluble sulphate of potash, and throwing down Atropia in the form of a precipitate. To purify it, he again added acid, then potash, and ultimately dissolved out the Atropia with hot alcohol; which, on cooling and distillation, afforded distinct crystals.

Medical Properties.—Belladonna is a very powerful anodyne and narcotic, and capable of affording much greater alleviation of our sufferings than many persons imagine. It acts chiefly by diminishing the sensibility of the nervous system, and thus relieving very severe and distressing pains. For this object it has been used in cancer, both topically and internally. It is given in hooping-cough, frequently with good effect, but requires caution. The dose of the extract should be, for a child, one tenth of a grain, three or four times a day, and gradually increased, till some dilatation of the pupil is produced. After that, it becomes dangerous. It is of great service in neuralgic affections, chorea, epilepsy, chronic rheumatism, gout, and most diseases which have their principal seat in the nervous system. It has had the reputation of being a prophylactic in epidemics of scarlet fever, taken in small doses several times in a day. I have seen it give great relief in the sore throat of scarlatina, and in sore throats unconnected with that disease. The method of using it is, to make a pill with a quarter or half a grain of the extract, and two or three grains of extract of Henbane, and let this be dissolved in the mouth, that the solution may come freely in contact with the tonsils. The pain and tenderness is much relieved, and the remedy may even tranquillise the system.

Belladonna has the power of dilating the pupil in a remarkable manner, either rubbed on the eyelids in the state of extract, or a little of its solution dropped into the eye, or even when taken internally. On this account it is used in partial cataract, to admit light laterally, if there be opacity only in the centre of the lens, also preparatory to the operations for cataract; and in iritis, to prevent or even endeavour to break down adhesions between the posterior surface of the iris and the coverings of the lens. It acts on the iris by paralysing the circular fibres, the iris consequently collapsing to the fixed point. Some say that it stimulates the radiating fibres, which is not very probable, as it has a contrary effect upon all other contractile fibres of the body; another theory of its action is, that it paralyses the retina, and, consequently, the stimulus of light is not conveyed to the nervous centre, and reflected upon the iris, thus making the contraction of the iris secondary to the stimulus of light upon the retina. By accoucheurs it has been applied to the os uteri, to relax its cervix, in cases of protracted labour depending upon rigidity of that part. It is an excellent application externally in the form of ointment or tincture, for which formulæ are now introduced into the London Pharmacopœia.

The extract of Belladonna has been much extolled during the last four or five years, as an external application to the breasts, when inflamed during suckling, and likely to proceed to suppuration. The extract is to be gently smeared on nearly the whole breast, around the nipple, and in less than twenty-four hours the pain and swelling subside, the breast becomes emptied, and the secretion of milk appears to cease in it for a time, and all danger of suppuration is averted. Purgatives in the meantime should be given. Several papers on the subject have appeared in the 'Lancet,' corroborative of its efficacy in these cases.

Dose.—Of the powdered leaves or extract, gr. ¼ to gr. j;
and sometimes may be extended to gr. ij.
Of the tincture ♏v to ♏xx.

If Belladonna be taken in over-doses by mistake, it causes the following symptoms: great dilatation of the pupil, heat and dryness of the fauces, uneasiness at the stomach, nausea, ineffectual efforts to vomit, pain in the bowels, vertigo, delirium, a feeble pulse, cold clammy perspiration, subsultus tendinum, convulsions, and sometimes death. It paralyses, in a great degree, the nervous system, rendering the body insensible to the usual impressions. The treatment to be pursued, is first to empty the stomach, either by the stomach-pump or emetics, which latter must be of the stimulating kind, such as sesquicarbonate of ammonia or mustard. Then a purgative should be administered, and stimulants as ammonia or brandy, in proportion to the degree of prostration. In the intestinal canal it leaves traces of inflammation, although its action is more that of a narcotic than that of an acrid poison.

Prep.—Extr. Belladonnæ,—Ung. Belladonnæ,—Tr. Beldonnæ.

BENZOINUM.

An exudation from the STYRAX BENZOINUM.

This tree, a native of Sumatra and Java, grows rapidly and attains a considerable size. When about six years old, the stem of it is wounded, and the juice flowing out becomes hardened, and forms the Benzoin of commerce. The best Benzoin exhibits a mixture of white masses, somewhat like tears embedded in a rather browner substance. The darkest coloured is most impure.

Benzoin, improperly named Gum-benjamin, (as there is no gum in it,) is a brittle solid, with a pleasantly fragrant odour, but little taste, leaving a sensation of heat and irritation about the fauces. It is entirely soluble in alcohol, from which water will cause its separation, with a milky appearance. To boiling water it imparts Benzoic acid, which amounts to about 13 per cent.; the rest of it is chiefly resin, with a trace of volatile oil and extractive matter.

Medical Properties.—Stimulating expectorant, but very rarely used, except to procure Benzoic acid. It is occasionally burnt in rooms, on account of its agreeable odour, and is a frequent ingredient in pastilles. It is an ingredient in the Tinct. Benzoini Comp.

Dose.—Gr. x to gr. xx.

Prep.—Acidum Benzoicum,—Tr. Benzoini Comp.

BERGAMII OLEUM.

Oil of Bergamot, distilled from the rind of the fruit of Citrus Limetta Bergamium.

This variety of Citrus is a native of Asia, and now cultivated in Italy, and some other parts of South Europe. The rind of the fruit only is valued. It contains a volatile oil, of a strong agreeable odour, which is extracted either by distillation or pressure. It is of a light yellow colour, and has a warm aromatic taste, and is known, commercially, by the name of Essence of Bergamot.

It is not given internally as a medicine. It is rarely used but to give its odour to disagreeable external applications, such as sulphur ointment and some others.

BISMUTHUM.

Bismuth is generally found in the metallic state, sometimes as a sulphuret, and very rarely oxidized. It is obtained most abundantly in Saxony, Bohemia, and Transylvania, and sparingly in Cornwall. As it fuses at a temperature of 497° by heat, it is easily removed from its impurities. It combines with oxygen only in one proportion. Metallic Bismuth, by being melted and allowed to cool, gradually forms most beautiful cubic crystals. It is not given by itself as a medicine, but is employed to procure the nitrate. For preparation of Nitrate, see Pharmac. Lond.

Medical Properties of the Nitrate.—Tonic, antispasmodic, and sedative, useful in pyrosis, gastrodynia, cardialgia, and some spasmodic diseases. Its action is more like that of a sedative than a stimulant, for it does most service when there is an excess of vascular action than the contrary. At all events it checks irritability of the stomach, and diminishes the sensibility of the nerves. As a tonic, it operates by bringing the vessels to their healthy and natural standard. It may be given in pills, or suspended in liquids by mucilage. It is liable to make the evacuations very black.

It is employed as a cosmetic under the name of Pearl-white.

Dose.—Gr. iij, gradually increased to ℈j.

If it is taken in very large doses, it lowers the vitality of parts of the stomach, reaction and inflammation ensue, sometimes to a highly dangerous extent. There is no treatment peculiar for poisoning by this substance. It must be managed by emetics, purgatives, and demulcents.

BORAX.

The *Biborate* of *Soda*.

Borax is procured from the impure salt, which is imported under the name of Tincal; it occurs in small quantities in Europe, most abundantly in Persia and Thibet, in lakes, from which it is separated by evaporation. The impure Borax concretes on the margins of these lakes, and is dug up in lumps. It is then in masses generally greenish, or rather yellow, covered with an earthy coating, greasy to the touch, and with an odour like soap. This greasiness is owing to fatty matter, combined with the soda. Another variety of Borax is imported from China, in a more purified state.

In France, Borax has been made by adding the acid to soda. The acid is procured in Italy, where it exists in some lakes, especially in Tuscany. This liquid is heated with carbonate of soda in excess, and the solution, on evaporation, yields crystals of Borax.

It is a white salt, generally crystallized in hexahedral prisms, terminating in triangular pyramids. It has a sweetish, feebly alkaline taste, and has an alkaline action on test papers, is soluble in twelve times its weight of cold, and in twice its weight of boiling water.

It has the property of rendering bitartrate of potash very soluble, forming a combination with it, named soluble cream of tartar, much used in some countries as a medicine. This compound is soluble in its own weight of cold, and in half its weight of boiling water.

Borax consists of—

2 boracic acid	2 × 35	= 70
I soda		= 32
		102
10 water	10 × 9	= 90
Atomic number when crystallized . .		192

It is consequently a biborate, and might be expected to possess an acid reaction; this is not the case, in consequence of the feeble nature of boracic acid, which is unable to overcome the alkaline nature of soda.

Medical Uses.—It is not given much internally. It has been recommended in nephritic or calculous affections, in which there is an excess of uric acid, in doses of half a drachm to a drachm. It is said to be diuretic, and even emmenagogue. Some assert that it stimulates the uterus like ergot of rye. I have tried it, but without the least effect. We now employ it in aphthæ, as what is called a detergent, in the form of Mel Boracis. It has a cooling effect upon parts to which it is applied, and when swallowed by children, is likely to do them more good than when only allowed to touch the parts of the mouth. It is considered to be a solvent of the epithelium, and is recommended to be applied to the skin in solution to remove freckles from the face.

Dose.—ʒss to ʒj.

Prep.—Mel Boracis.

BROMINIUM.

Symb., Br.

Bromine is an elementary substance, found in sea-water, and in many saline springs in various parts of the world. It is commonly associated with magnesium, sodium, or potassium.

It is procured generally from bittern, which is the residue of sea-water, after removing chloride of sodium, and the sulphate of magnesia. If chlorine be passed into this, it decomposes the bromide of magnesium, uniting with the magnesium, and setting free the bromine, which may be taken up by ether, or distilled over into a cool receiver. Another plan is to add to bittern sulphuric acid and peroxide of manganese, in which case, part of the oxygen of the manganese combines with the magnesium to form magnesia, the bromine is liberated and distilled over into cold water, in which it sinks, and we have sulphates of manganese and magnesia in the retort.

Bromine is a liquid of a deep reddish-brown colour. It is much heavier than water, in which it is usually kept to prevent its rapid vaporization. It has a strong smell and taste, boils at 117°; its vapour very much resembles nitrous acid gas; it is sparingly soluble in water, more so in alcohol, most in ether; with starch it forms a yellow compound; it corrodes the skin, and gives to it a yellow stain. In its compounds, there is great analogy between it and iodine.

Medical Uses.—Up to the present time, it has not been extensively tried for medical purposes. It appears to be very like iodine in its effects upon the body; chiefly acting on the lymphatic and glandular system; one reason, perhaps, for not employing it, is its great price, and the non-necessity of another remedy, which promises the same effects as iodine, but at the same time less manageable. A salt of it was ordered in the previous London Pharmacopœia, the *Bromide of Potassium*, but is omitted in the present one of 1850. This crystallizes in cubes, and closely resembles the iodide of potassium. It may be given in about the same doses, that is, the moderate doses employed by many, not such quantities as half a drachm to two drachms. Its compounds with mercury have been given on the Continent. They are powerful remedies, and demand almost as much caution as the bichloride of mercury. When taken in excess, albumen furnishes the best antidote.

Dose of the Bromide of Potassium—Gr. ij to gr. x.

The quantity of a quarter of a grain to 1 grain of bromine, may be taken dissolved in ether.

BUCHU.

The leaves of BAROSMA SERRATIFOLIA.

This is a very pretty shrub, growing about three or four feet high; a native of the Cape of Good Hope. The leaves only are officinal.

Properties.—The Buchu leaves bear some resemblance to those of Uvæ Ursi, but are generally longer, broader, and thinner; they are notched at their edges, dotted and pale on their under surface. Their odour is strong and somewhat aromatic; the taste bitterish and somewhat resembling that of the mints. Cadet de Gassicourt analysed them, and discovered, in 1009 parts—

A light brownish volatile oil	6·65
Gum	211·7
Extractive	51·7
Chlorophylle	11
Resin	21·51

Water and alcohol extract the active matter, which is chiefly the oil with extractive.

Medical Properties.—Gently stimulant, diuretic, and sometimes diaphoretic. The use of them was discovered from the Hottentots, who employ them in several diseases. They are chiefly given in complaints of the urinary organs, such as catarrh of the bladder, in gravel, morbid irritation of the bladder and urethra, and retention or incontinence of urine from a loss of tone in the parts connected with its evacuation. They have also been recommended in chronic rheumatism, and lately as a remedy for gonorrhœa, taken internally as a substitute for Copaiba. They may be given in powder, infusion, or tincture.

Dose.—Of the powdered leaves, ℈j to ʒss.

Prep.—Inf. Buchu.

CAJUPUTI.

l distilled from the leaves of the MELALEUCA

a small tree, growing in the Molucca islands. chiefly prepared in Amboyna and Borneo, and d from the East Indies in glass bottles. As it is emed in the East, and the supply of it is not very price of it is necessarily high.

ies.—Very fluid, transparent, with a bluish-green strong camphorous odour, and a warm taste. It latile, sp. gr. ·978, and it burns without leaving ne. The green colour has erroneously been attri- the copper vessels in which it has been distilled. of copper can be discovered by tests. The colour on the presence of chlorophylle. This oil is lly adulterated with oil of rosemary or turpentine, ted with camphor.

l Properties—Highly stimulating, producing a of wramth internally, and increased fulness and the heart and arteries. It has been given in retty freely, and may be used in colic, in chronic m, spasms of the stomach and bowels in the f inflammation, and is an elegant adjunct to ions. Medicinally, it is most consumed in the es.

–♏j to ♏v, suspended in a draught by mucilage, on a lump of sugar.

CALAMINA.

ne, the impure *Carbonate of Zinc*. The term is also applied to the silicate of zinc; but the only is officinal. It is found at Carinthia, and very abundantly in England. It exists in or earthy masses, sometimes crystallized, variable , either greyish, or greyish-yellow or brown. stallized it is a compound of—

1 carbonic acid = 22
1 oxide of zinc = 41
68

In the compact state, it is combined with water, and some impurities. By being heated, some carbonic acid is evolved; and by elutriation the Calamine is obtained in the form of an impalpable powder, consisting of oxide of zinc with a little carbonate, and a small portion of the impurities.

Calamine is only used externally in the treatment of ulcers. It is sprinkled on them as an exsiccant or absorbent, or in the form of an ointment, known as Turner's Cerate. This ointment is of use during the granulation of large ulcerations from burns, appearing to stimulate very gently the vessels to a healthy action.

Prep.—Ceratum Calaminæ.

CALCII CHLORIDUM.

Chloride of Calcium is made by adding hydrochloric acid to chalk, in which case, chlorine unites with the calcium forming the chloride, the oxygen of the lime with the hydrogen of the hydrochloric and forms water, and the carbonic acid is set free by heat; the chloride is obtained in an anhydrous state.

Formula Ca, Cl.

This substance is usually kept in the form of white semi-transparent amorphous flattened masses, but may be obtained crystallized with 6 eq. of water. It has a great affinity for water, is very soluble in that liquid, and absorbs water rapidly from the atmosphere, whence it is sometimes used for hygrometrical purposes. It is chiefly used in chemistry and pharmacy for the purpose of absorbing water, in drying gases, and rectifying some liquids. It was formerly used as an alterative, and much esteemed in the treatment of scrofula and rickets; but is now scarcely ever prescribed.

CALCIS HYDRAS.

Hydrate of Lime, or lime recently slaked by water.

Lime has a great attraction for water; when water is added to it, it combines with the lime and becomes solid, the lime at the same time crumbling, and a vast quantity of heat is disengaged, more than sufficient to boil water, and which is made available sometimes for purposes of cookery. During this action, a white cloud rises; this is watery vapour or steam, carrying up with it some particles of lime. This hydrate soon attracts carbonic acid from the air, and is converted into chalk. Hydrated lime is chiefly used for pharmaceutical purposes.

CALX.

Lime fresh burnt.

Lime does not exist in a pure state, but is found associated with carbonic and sulphuric acid; with the former it forms limestone, chalk, and marble; with the latter, alabaster and gypsum, which, by burning, constitute plaster of Paris. When the carbonates are exposed to a white heat, the carbonic acid is expelled, and the oxide of calcium remains. It is obtained most pure from white marble; that from common limestone often contains some alumina, silica, oxide of iron, occasionally magnesia and oxide of manganese. The lime from shells contains a portion of magnesia, phosphate of lime, and a trace of oxide of iron.

It is soluble in about 700 times its volume of water at 60°; and, contrary to a general law, is more soluble in cold than in hot water.

Composition:

$$\begin{array}{rl} 1 \text{ oxygen} = & 8 \\ 1 \text{ calcium} = & 20 \\ \hline & 28 \end{array}$$

Formula CaO.

Medical Properties.—Escharotic and antacid. It is very little used by itself. Internally it is given in the form of lime-water, in dyspepsia; it is also said to be good in worm cases, by dissolving and removing the mucus from the intestines; it is given in some calculous diseases, in rickets or mollities ossium, and in scrofula.

Prep.—Linimentum Calcis,—Liq. Calcis,—Pottassa cum Calce.

CALX CHLORINATA. (*Vide* DECOMPOSITIONS.)

CALUMBA.

The sliced root of the COCCULUS PALMATUS.

This plant is a native of Mozambique, on the eastern coast of Africa, where it grows spontaneously in great abundance. Its root is perennial. The stem is annual and climbing, bearing large palmated leaves. The root is dug up in the dry weather, and the fusiform offsets are selected, which are less fibrous and woody than the larger primary root. These are cut into slices and carefully dried in the shade. The drug is imported from India, whither it is carried by the Portuguese. It derives its name either from having been supposed to be a native of Colombo in Ceylon, or from Calumb, said to be the Mozambique name for the root.

Qualities.—It is usually in flat circular pieces, of a yellowish colour internally, brown externally. They are thinnest in the centre, and are marked with concentric circles, and radiating lines. The brightest pieces are preferred, which are compact and uniform, and not worm-eaten. The odour is slightly aromatic; the taste very bitter, and more so the cortical part. It is brittle, and easily pulverized; it absorbs moisture from the air, and is apt to undergo decomposition.

By analysis, M. Blanche found in it—

An azotized substance; a bitter principle (Calumbin), not precipitated by metallic salts; two thirds of its weight of starch; a small portion of volatile oil; salts of lime and potash; oxide of iron; silica.

The virtues of the root are extracted by boiling water and alcohol. The infusion undergoes decomposition very speedily in hot weather, and should, therefore, be made fresh every day.

Some years ago, Calumba root, being very dear, was much adulterated. This is not the case at present, as the adulterating substances are very easily detected, both by the external appearance and the aid of chemistry. The roots were those of Bryony, Costus Indicus, and Frasera Walteri. Real Calumba is readily distinguished by the effect of tincture of iodine upon it, producing a blue-black colour, and not affording any precipitate with the salts of iron.

Medical Properties.—Calumba is a very mild tonic, and may be given in stages of diseases when other tonics are inadmissible. It allays irritation of the stomach and bowels, partly, perhaps, by the starch in it; hence it is useful in checking vomiting, in the diarrhœas of infants, in cholera and dysentery. As a tonic, whilst the stomach is still weak, it is useful after fevers, for it acts without stimulating or constipating the bowels. Its infusion is a good vehicle for the salts of iron.

Dose of the powder.—Gr. x to ʒss.
Infusion, ℥jss, ter die.

Prep.—Infusum et Tinctura Calumbæ.

CAMBOGIA.

Gamboge is the gum resin obtained from an uncertain species of GARCINIA.

The tree usually described as yielding this substance grows in Siam and Cochin-China. The drug is obtained by breaking off the leaves and young shoots, from which the juice issues in drops, and gradually thickens and becomes solid. When it has attained to a necessary consistence it is rolled into cylinders, and wrapped up in leaves. Sometimes the juice is received into the hollow of the bamboo, and becomes cylindrical, and, as it contracts by drying, it has a hollow left in its centre. It is imported from Canton and Calcutta.

Gamboge is brittle, with a smooth conchoidal fracture; its powder has a bright yellow colour. It has no smell and little taste, but leaves a sensation of burning heat in the fauces. In 100 parts Braconnot found—

Gum	19·5
Impurities	0·5
Resin, with colouring matter	80
	100

Unlike most other gum-resins, it contains no essential oil. Triturated with water, it forms a bright yellow liquid, from which the resin will gradually be deposited. It is almost entirely soluble in alcohol; and is taken up also by alkaline solutions, from which it is partially precipitated by acids.

Medical Properties.—Drastic and hydragogue, cathartic, and somewhat diuretic. In large doses it is apt to disagree with the stomach, and cause vomiting. It is sometimes given in worm cases, mostly for tænia; and, in the treatment of dropsies, in combination with jalap or bitartrate of potash. From its ready solubility it operates freely upon the small intestines, and hence is an excellent substance to combine with aloes, which acts principally on the larger bowels: besides this, they appear to modify the action of each other. The compound Gamboge pill of the Pharmacopœia is particularly mild and agreeable in its operation.

Dose.—Gr. iij to gr. vj, and gradually may be increased to ten grains.

Prep.—Pil. Cambogiæ Composita.

CAMPHORA.

Camphor, a substance obtained from the CAMPHORA OFFICINALIS, *alias* LAURUS CAMPHORA.

The tree which is mentioned as affording Camphor is not the only one, as it is also procured from the Dryobalanops Camphora. It is likewise found in the root of the Laurus Cinnamomum, in the Sassafras, and in the oils of most of the Labiatæ, yet in so small a quantity that it would not recompense for the trouble of extraction. The Laurus Camphora is a large handsome tree, growing freely in China and Japan, and other parts of Eastern Asia. Through all parts of it, Camphor is diffused, and is obtained by sublimation from the trunk, root, and branches. All these parts are cut into chips, then placed with a little water in iron vessels, surmounted by earthen capitals, furnished with a lining of rice-straw. A moderate heat is applied, and the Camphor rises and is condensed upon the straw.

The Dryobalanops Camphora is a very large tree, growing sometimes as high as 100 feet. It is found in Sumatra and Borneo. Camphor is found in its trunk, in masses sometimes as thick as a man's arm, but this is comparatively rare; the quantity obtained from a very large tree, after much labour, very seldom exceeds twenty pounds in weight. The old trees contain the greatest proportion; the young trees, by incision, yield a volatile camphorous liquid, named in the East, Oil of Camphor, and much esteemed; very little camphor of commerce proceeds from this tree.

Camphor is brought to this country from Calcutta, Batavia, and Canton; most of it being derived from China and Japan. In the crude state, as imported, it is in granular masses of a dirty white colour, and mixed with extraneous matters. For medical use, it requires to be refined. For this purpose, it is mixed with quicklime and exposed, in a glass or earthenware vessel, in a sand-bath to a gradually increased heat, by which it is melted and afterwards passes in vapour into receivers, where it condenses. Thus refined, it is in large hemispherical cakes, one or two inches thick, perforated in the centre.

Qualities.—Its odour, appearance, and volatility, are well known to every one. It is pulverized with difficulty, unless a small portion of rectified spirit be added, which greatly facilitates it. Sp. gr. ·985. Water dissolves a very small quantity of it, scarcely a grain in an ounce. Its solubility in this liquid is increased by the addition of a little sugar or magnesia. Alcohol dissolves about 75 per cent. of its weight, which is precipitated on the addition of water. It is also soluble in ether, fixed and volatile oils, strong acetic, and the dilute mineral acids. It is now described as a compound of oxygen, with a hydrocarbon, named Camphine.

Medical Properties.— Stimulant, antispasmodic, diaphoretic, and possibly antiseptic. As a stimulant, it shows its effects more on the nervous than vascular system, causing exhilaration of spirits, whilst the pulse is only rendered fuller, but not harder or more frequent. When there is excessive irritation from protracted excitement, or abuse of stimulants, camphor appears to have a soothing, sedative, tranquillising action. As a general rule, it is more beneficial when there is debility of body than when there is plethora or inflammatory action, with locked-up secretions. The diseases in which it is best given are, the latter stages of typhoid fevers, confluent smallpox, remittent fevers of hot climates, rheumatism, dysmenorrhœa, some forms of mania, delirium tremens, and irritation of the urinary passages, especially such as attends the use of cantharides.

If camphor be given in too large doses, it produces dangerous symptoms, part of them such as arise from irritant poisons. These symptoms are nausea, vomiting, anxiety, faintness, vertigo, delirium, insensibility, coma, convulsions, sometimes death. The remedies recommended are, copious demulcents, with a pretty free use of opium.

Camphor is used with other medicines, with the intention of increasing or modifying their action. It helps to prevent the unpleasant headache consequent upon taking opiates. It makes senna act more pleasantly, and some say more powerfully. The *modus operandi* of camphor, in increasing the power of other remedies, is not very clear. Some say that it stimulates the absorbents to take up more of the active principle; others, that it relaxes the exhalants, which allow more fluid to escape; others refer its operation to its stimulating action on the capillary and exhalant vessels. It is said to promote the absorption of mercury, when rubbed on the surface; and this is also referred to excitation of the absorbents. Externally used, it is a local anodyne, dissolved in spirit or oil, and combined with laudanum. In this form, it relieves in gout, rheumatism, and chordee; and, in the form of enema, it allays tenesmus in cases of worms or dysentery.

To obtain the full effects of camphor, it may be given in pill or in solution. The pill is not so eligible, as some time may elapse before all the camphor is brought in contact with the coats of the stomach. A better plan is, to triturate the camphor with a few drops of spirit, then with mucilage, and afterwards water; or some camphor may be dissolved in almond oil, aided by heat; and a proper quantity of it, triturated with mucilage or the yolk of an egg, may be held in suspension and in a minutely divided state; so that when taken, the whole of it immediately exerts its action upon a large portion of the stomach. Camphor mixture is very weak, and is only used as a vehicle for other remedies. When it is wished that camphor should determine to the skin, it is better to combine with it tartar emetic, ipecacuanha, or nitre.

Dose.—Gr. v to g. x or xv.

Of the Camphor Mixture, ℥jss. to ℥ij.

Prep.—Lin. Camph.,—Lin. Camph. Comp.,—Lin. Hyd. Comp.,—Lin. Saponis,—Lin. Terebinthinæ,—Mist. Camphoræ,—Tinct. Camphoræ,—Tr. Camph. Comp.

CANELLA.

The bark of the Canella Alba.

This is a tree which grows naturally in Jamaica and other West Indian Islands, easily distinguished from other forest trees by the light colour of its bark. The drug is the bark of the branches deprived of epidermis, and carefully dried in the shade. It is in pieces of variable thickness and length, generally quilled, has an aromatic odour, somewhat like cloves, and a warm pungent taste. Boiling water extracts one fourth of its weight, but does not take up the warm aromatic principle. It yields its virtues to alcohol, which is rendered milky by the addition of water. Its constituents are—

Volatile oil; sweet substance resembling mannite; bitter extractive; resin; gum; starch; albumen; saline substances in small quantity.

The bark of the Drymis Winteri, or Wintera Aromatica, is sometimes mixed with and mistaken for Canella. Winter's bark contains tannin and a little oxide of iron, which are not found in Canella.

Medical Properties.—A warm aromatic, seldom or never prescribed alone. It is given most in combination with aloes, to render it more palatable and pleasant in its operation.

Dose.—Gr. x to gr. xv.

Prep.—Vin. Aloes.

CANTHARIS.

Cantharis Vesicatoria. Class, Insecta. Order, Coleopteræ. Family, Trachelides. Tribe, Cantharideæ. Latreille. *Spanish Fly.*

This insect is about eight to ten lines in length, by two or three in breadth, and of a brilliant green colour. When alive, these insects have a powerful odour, by which swarms of them can be known even at some distance. They frequent some trees in preference, as the white poplar, privet, ash, elder, and lilac, upon the leaves of which they feed. They are found in Spain, South of Italy, and Western part of Asia. They make their appearance in May and June, at which time they are generally collected, and are said to be most active at the period of copulation. The plan of collecting them is to shake the tree in the morning, from which the insects fall, having been benumbed by the cold of the night. They are then thrown into vinegar and water or hot water, to be killed, and subsequently dried either in stoves or by the heat of the sun. They are sometimes killed by burning sulphur under the trees to suffocate them.

Cantharides come from Spain, Italy, and other parts of the Mediterranean. They have been brought in considerable quantities from St. Petersburg, derived originally from the southern parts of Russia; and, on the authority of Dr. Thomson, they are brought most largely from Astracan, mixed with another fly, the Melolontha vitis, which does not blister, and must be carefully removed from the blistering fly.

Qualities.—Spanish flies, when dried, preserve considerably their unpleasant odour, and have an acrid, burning, urinous taste. If kept perfectly dry they may retain their virtues for some time. Exposed to moisture, they soon putrify, and this most readily occurs when they are in a state of powder. Even with care, they are apt to be attacked by mites, which consume the soft interior parts, leaving the harder external portion uninjured. Some have erroneously supposed that they removed only the inert portion. It has been proved that, although the part left has vesicating qualities, it is not near so active as the sound fly. Camphor does not effectually preserve them. They are said to be protected more by having been immersed in strong pyroligneous acid.

Robiquet found in Cantharides—

A green oil, *inert;* black matter, soluble in water, *inert;* yellow viscid matter, soluble in water and alcohol, *inert;* cantharidin, the active substance; fat, insoluble in alcohol; phosphates of lime and magnesia; acetic acid, and in the fresh flies, uric acid; a volatile principle, procurable by distillation.

Cantharidin is a white substance, in scales of a micaceous arance, insoluble in water and cold alcohol, but soluble her, oils, and hot alcohol. The yellow matter in the iowever, appears to render cantharidin soluble in water old alcohol, as we find a decoction, or tincture, very e in exciting vesication. Cantharidin is procured by ng first a watery extract from the fly; then treating it hot alcohol to take up the cantharidin with the yellow r. The yellow matter is subsequently removed by ing with cold alcohol.

dical Properties.—As an internal remedy, Spanish re stimulant and diuretic. Their action is particularly ed upon the urinary organs, beneficially in some cases langerously when exhibited in excessive doses. This ly is prescribed in dropsies where there is debility, crease the secretion of urine, in gleet, leucorrhœa, and orrhœa, incontinence of urine depending on debility irtial paralysis of the neck of the bladder. If the given be excessive, it will cause inflammation of the ous coat of the intestinal canal, and a similar state of irinary passages, attended with bloody urine and gury, great excitation of the genital organs, priapism, To combat such symptoms, copious diluents with hor and opium, are found most useful, followed by ig saline remedies to subdue the inflammation. Cases s kind are occasionally met with from an iniquitous iistration of this drug, under an impression that it es sensual feelings, and many a life has been sacrificed ch brutality. Some medical men are in the habit of the tincture of cantharides internally in hooping-i, but on what principle is not clearly stated. It oly acts by revulsion, that is, irritating the mucous ce of the intestinal canal, and diverting the current ood from the lungs to that part.

e chief use of cantharides is in the form of the blister er, as an external application. Thus employed, it is a stimulant, rubefacient, and vesicant. There are motives for its use, and several modes by which it es. As a general rule, blisters are not to be employed e height of inflammatory action, nor until the system ieen somewhat reduced by depletion. The most ent object in using them is to divert the current of from an adjacent part, and to direct the nervous energy to another part, where the inflammatory process is less injurious. The irritation producible by them can be controlled according to our wishes, either just so far as to redden the surface, or to produce an effusion of serum, and even by protracted irritation to establish a suppurating surface. The vesication is effected by serous fluid being thrown out under the epidermis from the vessels of the cutis vera, to protect it from the further influence of the irritant. The time requisite for vesication varies with age, sex, constitution, and the stage of the disease. In general, blistering plasters may be kept on adults for twelve hours, but if there is a low state of the vital powers, they will have scarcely any action, even in twenty-four hours; hence a vulgar opinion that if vesication does not occur in severe diseases, the patient is beyond recovery. In children and delicate females they act very speedily, often in the course of two hours, and in children particularly they require to be carefully watched, when used after some severe and depressing diseases, such as measles, or scarlatina, &c., for, if left on too long, they will often occasion sloughing of the parts. A great objection to the use of this remedy is the tendency in some constitutions to occasion inflammation of the urinary organs. To obviate this, the patient should drink, previously, copious demulcents, such as almond emulsion, linseed tea, or gruel, and the blistering plaster itself may have a little camphor and opium rubbed on it, or gauze or tissue paper may be interposed between it and the skin. Should, however, bloody urine and strangury come on, the remedies are, copious demulcent drinks with camphor and opium, an emollient poultice applied over the blistered surface, the use of the warm bath, and an enema of starch, with some camphor and opium. In young children, the plaster should be removed as soon as the skin is reddened, and replaced by a mild poultice, which will generally ensure vesication.

The diseases in which blisters are employed are too numerous to mention individually. They are useful in typhoid diseases, to stimulate and rouse the system, and sometimes to act as counter-irritants. They have been employed in remittent and intermittent fevers, to subvert morbid associations. By revulsion, they benefit in cynanche, in the inflammatory diseases of the pulmonary and ab-

viscera, and are most efficacious in chronic
s, in which it is probable that, by drawing the
the surface, the subjacent weakened and over-
d vessels have an opportunity of recovering their
alibre, and returning to their healthy functions.
—Of the tincture xv to xxx minims, of the
l fly, gr. ¼ to gr. j.
—Acetum Cantharidis,—Ceratum Canth.,—Empl.
-Tinct. Canth.,—Ung. Canth.

CAPSICUM.

erries of the CAPSICUM FASTIGIATUM.

arieties of capsicum are, annual herbaceous plants,
of Asia and America, where they grow in the
luxuriance. The Capsicum Fastigiatum or Fru-
is the species which affords the Cayenne pepper.
ies of the Capsicum Annuum are generally grown
it in our country, and are also much employed in
of pickle.

lour of Capsicum berries is peculiar and somewhat
, stronger in the fresh than the dried state. The
acrid and burning, causing an intense heat in the
which lasts for some time. The acrimony, ac-
to the analysis of Braconnot, depends upon an
esinous substance, which he named *capsicin*, and
e extracted chiefly by the agency of ether. He
it as an oil or soft resin, of a reddish-brown
vith an insupportably hot and pungent taste. It
y soluble in vinegar and water, most so in alcohol,
nd oil of turpentine. In addition to capsicin,
ot found in the berries—

ng matter; an azotized substance; gum; woody fibre;
tera.

ayenne pepper used as a condiment, has sometimes
dulterated with the common litharge. The fraud
ly be discovered, by putting some of the pepper
egar, and heating it, and then applying to the
the ordinary tests for lead, which will instantly

al Properties.—Capsicum is a powerful local sti-
and, in a less degree, excites the system generally.

It is usually given to stimulate the stomach to healthy action, as in some forms of dyspepsia and atonic gout, and it is combined with Quina, in intermittents, when there is torpor of the system. It is considered to be useful with a vegetable diet, in preventing flatulent distension of the intestines.

The most common use made of it with us is in the form of gargle, in atonic states of sore throat, as in scarlatina, or in a relaxed condition of the uvula. The gargle may consist of from one to two drachms of the tincture, to twelve ounces of rose-water, or may be made by infusing half a drachm of the powder in a pint of water.

Dose.—Gr. ij to gr. v.
Of the Tincture ♏x to ʒss.
Prep.—Tinctura Capsici.

CARBO ANIMALIS.

Animal Charcoal, prepared from bullock's blood, flesh, or bones.

This substance is made by exposing bones and other animal substances to a great heat, such as is able to effect destructive distillation. A quantity of ammonia and carbonic acid will pass off, and a black carbonaceous matter remains, which, when bones are used, is also associated with a large portion of earthy matter. This earthy substance can be removed by the action of hydrochloric acid, which will produce soluble chloride of calcium and soluble superphosphate of lime. By continued washing these are removed, and the purified charcoal remains. It is now ordered in the Pharmacopœia, to be obtained from bullock's blood. Thus prepared it possesses the most powerful decolourising qualities.

Animal charcoal is not employed as a medicine; it is much used in pharmacy to decolourise various substances, and is considered by Dr. Garrod to act as an antidote to many vegetable poisons containing alkaloids, as aconite, opium, &c., &c.

CARBO LIGNI.

Wood Charcoal.

This substance is commonly obtained by the slow com-on of wood, and is managed in the following manner. ts of wood are piled up in heaps, and then covered with turf, excepting an aperture left at the top, and her at the bottom, to allow a current of air at the time the wood is first ignited. When ignition has taken ; the top is covered over, and the combustion proceeds ly and imperfectly. The gaseous products escape, and : remains a black, light porous mass, which we call ;oal.

ıother plan for procuring it is to submit wood in iron ders to destructive distillation, by which we obtain ›nly very good charcoal, but, at the same time, the ıre pyroligneous acid; charcoal procured by either of above processes contains several impurities, chiefly : salts of lime and potash; to remove these, it may be ed with dilute hydrochloric acid, and frequent washing water.

[edical Properties.—It is said to be antiseptic, absor-, and mildly aperient. It may be of service in dysia, where there are fetid eructations, or in dysentery, ›rrect the fetor of the stools. It is applied to fetid sive sores, as an antiseptic, and to remove the diseable smell.

ıe most common use made of it is as a tooth-powder, rhich it is decidedly well adapted.

ose.—Gr. x to ʒss.

As an aperient, ʒij to ℥ss.

CARDAMOMUM.

ıe seeds of ELETTARIA CARDAMOMUM, or ALPINIA DAMOMUM.

ıis plant is a native of the mountainous regions of ıbar, where it grows spontaneously in great abundance. ·gins to yield fruit about the fourth year of its growth. ıs a tuberous horizontal root, or rhizome, which sends umerous perennial stems. The scapes or flower-stalks eed from the base of the stem, and lie close upon the nd, with flowers arranged in the form of a panicle. fruit is a three-celled capsule, containing numerous ı. When ripe, they are gathered and dried over a gentle fire, and by rubbing in the hand are separated from the stalks.

The seeds have a fragrant odour, and a warm, pungent, highly aromatic taste. These properties are extracted by water and alcohol, but most powerfully by the latter. They depend upon a volatile oil, which arises by distillation, to the amount of 4·6 per cent. Alcohol extracts from them 12·5 per cent. of an acrid burning resin and extractive matter. The seeds should not be kept in a state of powder, for the qualities are best preserved whilst they are in their capsules.

Medical Properties.—An agreeable warm aromatic and stimulant, much used as an adjunct to cordial, tonic, and purgative medicines. In the East Indies they are used as a condiment, and almost looked upon as one of the necessaries of life.

Dose.—Gr. v to gr. x.

Prep.—Conf. Aromatica, — Dec. Aloes Comp., — Pil. Coloc. Comp.,—Pulv. Cinnamomi Comp.,—Tinct. Cardamomi.—Tinct. Card. Comp.,—Tinct. Cinnamomi Comp., —Tinct. Gent. Comp.,—T. Sennæ Comp.

CAROTA. (*Vide* DAUCI RADIX.)

CARUI.

The seeds and oil of CARUM CARUI.

This umbellate plant is biennial, and a native of the South of Europe, The seeds of the second year's growth are the best. They are chiefly imported from Germany, but are also grown in considerable quantity in our own country. The root in some parts is eaten, bearing a great resemblance in its qualities to parsnip.

These seeds have a pleasant aromatic smell, and a sweetish, warm, spicy taste. These properties depend on an essential oil, which they afford largely by distillation. The residue is insipid. Water and alcohol extract their virtues.

Medical Properties.—Stomachic and carminative, used in flatulent colic, and as an adjuvant or corrective to other medicines. The seeds are often used in cakes, and are thought to stimulate the digestive organs.

Dose.—Gr. x to gr. xx.
Of the Oil, four or five drops.

Prep.—Aqua Carui,—Conf. Opii,—Conf. Rutæ,—Oleum Carui,—Spiritus Carui,—Sp. Juniperi Comp.,—Tinct. Sennæ Comp.,—Pil. Aloes Comp.,—Pil. Rhei Comp.

CARYOPHYLLUM.

The dried unexpanded flowers and oil of the CARYOPHYLLUS AROMATICUS.

This tree, a native of the Moluccas, is an evergreen, and flowers throughout the whole year. The flowers are disposed in terminal corymbose panicles, and give out a strong penetrating fragrant odour. The unexpanded flower-buds only are officinal; they are first gathered when the tree is about six years old. They are picked by the hand, or separated from the tree by long reeds, and then quickly dried. In the Moluccas they are said to be sometimes immersed in boiling water, and afterwards exposed to smoke and artificial heat, before being dried in the sun. In Cayenne and the West Indies, they are simply dried by the solar heat.

Properties.—Cloves have externally a deep-brown colour, internally reddish; an odour strong and fragrant; and a hot pungent aromatic permanent taste. The best are large, heavy, brittle, and when pressed give out a little oil. When light, soft, wrinkled, or pale, and of a feeble taste and odour, they are inferior. In 1000 parts Tromsdorff discovered—

Volatile oil	180
Astringent extractive matter	170
Gum	180
Resin	60
Vegetable fibre	280
Water	180

M. Lodibert discovered, subsequently, a fixed oil of a greenish colour, and a white resinous substance without taste or smell, soluble in ether and boiling alcohol. This substance, named by Bonastre *caryophyllin*, was found in the cloves of the Moluccas, Bourbon, and Barbadoes, but not in those of Cayenne. Berzelius considers it to be a stearoptene.

Water extracts the odour of cloves, but little of their taste. All their sensible qualities are imparted to alcohol. By distillation, cloves afford a volatile oil in considerable quantity, amounting to about one sixth of their weight.

Medical Properties.—Stimulant and aromatic, useful in colicky pains, some cases of dyspepsia, and to correct the griping effects of some other remedies. They are seldom used uncombined. The oil of cloves dropped into a carious tooth will oftentimes relieve toothache.

Dose.—Gr. v to gr. x.

Prep.—Inf. Caryophyllorum,—Conf. Aromatica,—Conf. Scammonii,—Inf. Aurant. Comp.,—Sp. Ammoniæ Arom.,—Vinum Opii.

CASCARILLA.

The bark of the Croton Eleuteria.

This is a small tree or shrub, which grows in the Bahamas, in Hayti, Peru, and Paraguay. The bark of it only is officinal.

Cascarilla has an aromatic odour, and a warm, spicy, bitter taste. It is brittle, and breaks with a short fracture. When burning it emits a pleasant odour, which distinguishes it readily from other barks, and on which account it is an ingredient in pastilles, and is occasionally mixed with tobacco to improve the odour of its smoke. Tromsdorff found in 100 parts of it—

Greenish yellow volatile oil	1·6
Brown, soft, rather bitter resin	15·1
Bitter extractive, with gum and traces of muriate of potash	18·7
Lignin	65·6

Either water or alcohol partially extracts its virtues, which are best taken up by diluted alcohol.

Medical Properties.—It is a tonic and aromatic, and has been recommended as a substitute for cinchona in intermittents, but affords a very inefficient one. It is given in dyspepsia, as a tonic after long fevers, chronic diarrhœa, or dysentery. It is considered by many to be an elegant tonic, for which reason principally it is prescribed. As it contains no tannin or gallic acid, the infusion might be employed as a vehicle for the salts of iron.

Dose.—Gr. x to gr. xx in powder.
Of the Infusion, ℥jss.
Tincture, ʒj to ʒij.
Prep.—Infusum et Tinct. Cascarillæ.

CASSIA.

The pulp of the legumes of the Cassia Fistula.

This tree obtains a considerable size, and is found in most tropical climates in Asia, Africa, and America. Our supplies are chiefly from the East and West Indies. The fruit, which is the officinal portion, is a long cylindrical, woody, dark-brown, pendulous pod, internally divided into numerous cells by thin transverse plates, which are covered with a soft black pulp. Each cell contains a single, oval, shining seed. The pulp is extracted from the pods by bruising them, and then boiling them in water, which dissolves the pulp; and this is procured sufficiently inspissated by evaporation.

Medical Uses.—Mildly laxative, seldom prescribed except for children, or as an ingredient in the confection of senna. If given in doses sufficient to purge, it is apt to cause nausea, griping, and flatulence.

Dose.—℥ss to ℥j.
For a child, ʒj to ʒiij.
Prep.—Conf. Cassiæ,—Conf. Sennæ,—Cassia Prep.

CASTOREUM.

A concretion found in the follicles of the prepuce of the Castor Fiber, Common Beaver.

In the beaver, between the anus and external genitals of both sexes, there exist two pairs of glandular follicles; the lower of which are larger, and contain a highly odorous viscid substance, secreted by glands placed near these follicles. The substance contained is called Castor. After the death of the animal these bags are removed, and dried either by smoke or in the sun.

Castor is described as coming from Russia and Canada, but it appears that at present our supply is exclusively derived from the latter locality.

Properties.—It has a strong peculiar odour, a bitter, acrid, and nauseous taste, and a reddish-brown colour. It varies in consistence, according as it has been dried. When quite dry, it is hard, brittle, and of a resinous fracture. Brande analysed and found in it—

Volatile oil; resinous matter; albumen; osmazome; mucus; urate, carbonate, benzoate, phosphate, and sulphate of lime; acetate and muriate of soda; muriate, sulphate, and benzoate of potash; carbonate of ammonia; membranous matter; castorin.

Castorin is supposed to be the peculiar active principle. It crystallizes in diaphanous fasciculated prisms; has strongly the smell of castor, with a taste as of copper. It is insoluble in water and cold alcohol, soluble in hot alcohol and essential oils. It is procured by treating castor with hot alcohol, filtering the solution, and allowing it to cool, when the castorin is thrown down. Water takes up the virtues of castor very imperfectly; alcohol and sulphuric ether more effectually.

Medical Properties.—This drug is of very little actual service. It is stimulant and antispasmodic, and is given in nervous affections, especially hysteria; also in low nervous fevers, in epilepsy, and in some other ambiguous nervous diseases: it is thought by some to be emmenagogue. It is often prescribed in absurdly small-quantities, as if serious consequences were to result from over-doses.

Dose.—Gr. x to gr. xx.
Of the Tincture, ʒj to ʒij.

Prep.—Tinctura Castorei.

CATECHU.

The extract from the wood of the ACACIA CATECHU, or UNCARIA GAMBIR.

This tree is a native of Hindostan; it does not grow to any considerable height, seldom exceeding twelve feet. The wood of the tree is cut into pieces and boiled in water, and the solution is evaporated to the consistence of an extract. This is then exposed to artificial heat, or that of the sun, and becomes perfectly dry and hard, forming the drug known as Catechu.

There are three forms of it which are most commonly met with; either it is in large irregular masses, or in squares of rather more than an inch in diameter, or in flattened rounded cakes. In addition to these, there are several other varieties less common, which are described in some large works of Materia Medica. Catechu is commercially distinguished as Bombay and Bengal, and they present some difference in composition. The Bengal catechu is procured from the province of Bahar, and is shipped from Calcutta. The Bombay variety is prepared in Canara, and sent direct from Bombay. The variety in the form of flattened cakes is brought from Ceylon, and is the produce of Areca Catechu. The cubical kind is chiefly from Singapore, and is obtained from Uncaria Gambir.

Catechu is inodorous, with an astringent, slightly bitter taste, followed by a sense of sweetness. It is brittle, and in some pieces breaks with a shining resinous fracture. The darker varieties are best. Several impurities are often mixed up with it. The chief constituents are tannin, extractive matter, and mucilage. In two hundred parts of the Bengal and Bombay catechu, Sir Humphrey Davy found—

	Bengal.	*Bombay.*
Tannin	97	109
Extractive	73	68
Mucilage	16	13
Insoluble, residue	14	10

It is now described by Buchner as containing a peculiar astringent principle, named Catechine, combined with Catechuic acid.

Catechu is almost entirely soluble in large quantities of water, only a small quantity of earthy matter and impurities remaining behind.

Medical Properties.—Catechu is astringent, and somewhat tonic. It is a very useful remedy in diarrhœas and some forms of hæmorrhage. It is used for relaxed velum and uvula, in the form of a gargle, or a small portion may be masticated. It may also be employed as an injection in gleet and leucorrhœa. Alkalies diminish its astringent qualities, and therefore should not be prescribed with it.

Dose.—Gr. x to gr. xxx.
Of the Tincture, ʒj to ʒiij.
Infusion, ℥j to ℥ij.

Prep.—Infusum Cat.,—Tinctura Catechu.

CERA FLAVA ET ALBA.

Wax.—A concretion prepared by the bee.

This substance is a product of the common bee, the Apis Mellifica: the elements which form it are collected from plants, but it is elaborated and excreted from the body of the insect. Its use is to form the cells in which honey and the larvæ are deposited.

Yellow wax is obtained by slicing the honey-comb, then draining away and pressing out the honey, and melting the residue in boiling water, and keeping it hot for some time to separate impurities. When the liquid cools, the wax concretes, and being removed is again melted in boiling water; then strained and poured into suitable vessels. It is brought to the markets in thick round flat cakes. In addition to that procured in our own country, some is imported from the European continent and Africa.

Wax is resolved by chemists into two principles; viz. cerin, soluble in alcohol, and myricin, much less soluble in that menstruum.

White Wax, Cera Dealbata, is procured from the common wax by discharging its colour: this is effected by exposing it with an extended surface to the agency of air, light, and moisture. For this object, the wax previously melted may be made to fall on a revolving cylinder, kept constantly wet; on this it forms thin ribbon-shaped layers. These are then removed and spread on linen cloths, and exposed to air and light, being occasionally watered and turned. In a few days, and by a repetition of the process, the wax becomes quite white; it is then melted and formed into thin flattened circular pieces.

White wax, being more expensive, is occasionally adulterated with white lead and tallow. These are easily detected by melting the wax in water; white lead rapidly sinks, and the tallow evolves a very unpleasant odour, and gives a dull opaque appearance to the water. If starch has been mixed with it, it will be detected by being left undissolved by oil of turpentine.

Medical Properties.—Wax is chiefly used as an ingredient in cerates, ointments, and plasters. It is said to be a demulcent and emollient, if taken internally; and has

:commended to sheath the bowels in diarrhœa and ery. If so employed, the best method of using it be to melt some of it with almond oil, and, whilst and liquid, triturate it with the yolk of an egg, or d it in some mucilaginous fluid. The dose might to ʒj, two or three times a day.

.—Various cerates, ointments, and plasters.

CEREVISIÆ FERMENTUM.

is the frothy substance which rises to the surface during fermentation; also during the fermentation : other saccharine liquids.

frothy, viscid, semifluid, of a dirty yellowish colour, ur resinous odour and a bitter taste. At 60 or 70, ose vessel or damp atmosphere, it soon putrifies. d to heat, it becomes dry and brittle, and preserves lities for a long space of time.

t is now considered to be a mass of very minute gamous plants, to which various names have been viz. Cryptococcus Fermentum (Kützing), Myco-Cerevisiæ (Desmarières), Torula Cerevisiæ (Tur-

composition of yeast is still much disputed: it to contain a proteine compound, celulose or starchy , a trace of phosphorus and sulphur, with an oily and some ash containing potash.

ical Properties.—It is thought to be antiseptic, and en given in typhoid fevers, in half-ounce and one-doses. It is most used as a poultice for fetid, ill-oned, or gangrenous sores, which it relieves from tor, and often appears to stimulate to a more healthy

chiefly valued for the power it possesses of exciting fermentation, and the panary fermentation in fari-s substances. This property depends most upon minating power of its cells.

.—Cataplasma Fermenti.

CETACEUM.

maceti.—A concretion, found in cells of the head of YSETER-MACRO-CEPHALUS.

This species of whale is often from sixty to eighty feet long, with an enormous head, constituting one third of its length. In the upper part of the head there are large cavities separated by cartilaginous partitions, containing an oily liquid, which, after death, concretes into a whitish spongy mass, consisting of spermaceti, mixed with oil. This is removed, and the oil is separated by draining. The quantity of spermaceti obtained from a whale, on an average, is said to be sufficient to fill twelve large barrels. It is further purified by washing with hot water, melting, and straining; and, finally, treating with a weak hot ley of potash.

Spermaceti melts at 112°. Its sp. gr. is ·943; it is insoluble in water; partially soluble in alcohol, ether, and oil of turpentine; easily soluble in the fixed oils. By chemists it is considered to be a distinct principle, named *Cetin*.

Medical Properties.—It is seldom prescribed for internal use, although it is supposed to be demulcent, and capable of sheathing and smoothing the mucous membrane of the alimentary canal, and was once thought efficacious in relieving the genital parts of the female after labour. A very nice spermaceti mixture may be made by rubbing two or three drachms of it to powder, with the aid of a few drops of rectified spirit; then adding sugar and the yolk of an egg, and subsequently eight ounces of rose-water. The spermaceti is suspended, and the mixture is very agreeable in coughs or sore throats. The chief use, however, of this substance, is in making cerates and ointments.

Prep.—Cerat. Cetacei,—Ung. Cetacei.

CETRARIA.

CETRARIA ISLANDICA.—*Iceland Moss.*

This plant belongs to the natural order Lichenes. It is found in the northern latitudes of Europe, Asia, and America; and is named Islandica, from the abundance of it found in Iceland. When dried it is of various colours, greyish-white, brown-red in parts, and somewhat green. It is inodorous, and has a bitter mucilaginous taste; boiling water extracts all its soluble principles. The decoction thickens on cooling, and acquires a gelatinous consistence.

The substance producing this effect considerably resembles starch, but differs from it in producing no effect upon iodine. Berzelius analysed this moss, and found in 100 parts—

Uncrystallizable sugar	3·6
Bitartrate of potash, with tartrate and phosphate of lime	1·9
Green wax	1·6
A peculiar bitter principle	3·0
Colouring extractive matter	7·0
Substance resembling starch	44·6
Gum	3·7

The bitter principle is, when pure, pulverulent; of a light yellow colour, inodorous, intensely bitter; slightly soluble in water, more so in alcohol, and freely in the liquid alkalies.

In Iceland and Lapland this vegetable is eaten as food, after the bitter substance is removed by maceration in water for some hours, or in water to which a little potash has been added.

Medical Properties.—Tonic, nutritious, and demulcent. At one time it was celebrated as a remedy for consumption, but at the present time such a notion is abandoned, although in that disease it may have a palliative, soothing effect. It is useful in coughs and in ulceration, and inflammation of the mucous membrane of the intestinal canal, giving some tone to the stomach, and at the same time sheathing and lubricating the mucous membrane. It is generally given in the form of a decoction, and may be taken *ad libitum*.

Prep.—Decoctum Cetrariæ.

CHIMAPHILA.

The leaves of Chimaphila Umbellata, or Corymbosa. —*Winter Green.*

This plant is named by some authors Pyrola Umbellata. It is an evergreen, with a perennial creeping yellowish root, from which spring several stems, from four to eight inches high, woody at their base. The leaves and stems are the parts commonly used and found in shops. It is a native of northern latitudes, and is scattered over the northern parts of Europe, Asia, and America.

This plant, named in America Pipsissewa, when fresh and bruised, exhales a peculiar odour. The taste of the leaves is bitter, astringent, and sweetish; the stems have a similar taste, with more pungency. Boiling water and alcohol extract the active qualities. The chief constituents are *bitter extractive*, *tannin*, *resin*, *gum*, *lignin*, and *saline matters*.

Medical Properties.—Diuretic, tonic, and astringent. It is recommended in dropsies, in cases attended with disordered digestion and debility, also in nephritic and calculous affections; and in the same cases as those in which uva ursi is generally prescribed. It is said also to be useful in scrofula, both before and after ulceration; and it has proved highly efficacious in some obstinate ill-conditioned ulcers and eruptions, connected with a strumous diathesis, used both internally and as a wash.

Dose.—Of the watery Extract, gr. x to gr. xx.
Of the Decoction, lb. ss to lb. j, in the course of twenty-four hours.

Prep.—Decoctum Chimaphilæ.

CINCHONA FLAVA, or CALISAYA.
CINCHONA PALLIDA, or CONDAMINEA.
CINCHONA RUBRA, or OBLONGIFOLIA.

The bark of each of these varieties of Cinchona is the officinal portion; that from the first is named *yellow-bark*, from the second *quilled* or *pale-bark*, and from the third *red-bark*.

Cinchona was introduced into Europe about the year 1640, and was known to Europeans only three years before that time. The first account given of the tree was by La Condamine, one of the French academicians, and upon the authority of Linnæus it was first named Cinchona Officinalis, in honour of the Duchess de Cinchon, who first took it in Europe; during succeeding years several varieties of Cinchona were discovered in other countries by naturalists, so that the number became very large, and great confusion existed on the subject. Decandolle, who has skilfully investigated the botanical characters of these trees, has divided them into eight genera, viz., Cinchona, Buena, Remigia, Exostemma, Pinckneya, Hymenodyction, Luculia, and Danais.

The true Cinchona exists principally in Peru, New Granada, and Bolivia.

The Cinchona tree is of some size, growing from thirty to forty feet high, widely diffused, extending from Buenos Ayres as far as Santa Martha on the northern coast. It is commonly found at an elevation of four or five thousand feet above the level of the sea, where the temperature is much lower than that of the tropical climates where it is found.

Even the genus Cinchona contains a large number of species, amounting, according to Ruiz and Parron, to thirteen; on Lambert's authority, to sixteen; and even more according to some naturalists. In this matter there is great uncertainty, as it appears that the character of the leaves and bark will vary with locality, temperature, and elevation, so that it is even possible that the three officinal barks may be the product of the same tree, only growing under different circumstances. Baron Humboldt paid little attention to the species, and summed up by saying that the Cinchonas alone were febrifuge which had a tomentose flower.

Cinchona bark is collected in South America by men who go out in parties, and are called Cascarilleros. They are persons who have had much experience, and are able to discriminate between the good and bad barks. The dry season selected for the collection of it is from September to November.

The plan they pursue is to cut into the bark, and on removing a small portion, ascertain whether it turns red on the inside in a few minutes by exposure to the air. This is a test of its goodness. They then proceed to peel it off by the blunt edge of an instrument, and by exposure to the sun it dries and assumes a quilled appearance. This applies only to thin bark; for we sometimes receive it in large pieces, flattened and of some thickness. The bark so collected is carried to depôts, where it is sorted and packed up in boxes named serons, and covered with the hides of the ox or buffalo. The best bark is heavy, of moderate thickness, of a splintery fracture, and should not be in quills of a spiral form. It has been classified under seven heads as to the external colour, known as, 1, blackish—2, curled—3, dark leopard-grey—4, bright leopard-grey—5, lizard coloured—6, very white—7, ash coloured. Another classification of cinchonas has been made according to the countries from which they are exported. This is attended with great difficulty, inasmuch as similar barks are exported from different places, and these will be found to vary at times. In a medical point of view such an inquiry is not of great value, particularly as so much doubt exists upon the natural history of this drug. We distinguish the three medical varieties by their colour, into *pale*, *yellow*, and *red*.

Pale Bark has received its name from the colour of the powder which it produces, and grey from the colour of its epidermis; the bulk of it is quilled, and the finest kind of it is said to be no larger than a goose-quill. Its taste is moderately bitter, subastringent, and not nauseous. It has a feeble, somewhat aromatic odour. It is exported from Loxa and Huanuco, and is presumed to be the product of Cinchona Condaminea, Scrobiculata, and Lancifolia. It is known as Loxa Bark, and the finest specimens form the Crown Bark of Loxa.

This variety contains on an average 2 per cent. of cinchonia, and nearly 0·5 per cent. of quina.

Yellow Bark is named in Bolivia, Calisaya Bark. It comes over quilled, and in large flat pieces; when broken it presents numerous shining points, and minute spiculæ, which will perforate the skin and occasion much annoyance. The taste is less astringent, but more bitter and more nauseous, which would distinguish it from the pale, although the quills have some resemblance. The flat pieces are less active than the quills. It contains from 2 to 3 per cent. of quina, and a very small quantity of cinchonia.

The *Red Bark*, the produce of unknown species, is generally in large flattened pieces, sometimes quilled, always rather thick, with occasionally an uneven warty surface. The taste is bitter and astringent; the odour very like that of the other barks. It is chemically distinguished by containing a large proportion of quina and cinchonia, amounting to from 3 to 4 per cent.

The chief proximate principles which are found in the cinchonia barks, as determined by chemists, are the following: quina, cinchonia, quinidine, kinic, tannic, and kinovic acids; cinchona-red, yellow colouring matter, green fatty matter, starch, gum, and lignin, with a small quantity of earthy matter.

The *fatty matter* is of a greenish colour from the pale bark, orange yellow from the yellow bark; insoluble in water, sparingly soluble in alcohol, very soluble in ether, and capable of forming soaps with alkalies.

The *red colouring matter, red cinchonic* of Reuss, is reddish-brown, insipid, inodorous, very soluble in alcohol, almost insoluble in ether and water, although the latter dissolves a little at boiling heat. Acids promote its solubility in water. It precipitates tartar emetic, but not gelatine. It is precipitated by acetate of lead; is most abundant in the red bark, least so in the pale.

The *yellow colouring matter* has little taste, is soluble in water, ether, or alcohol, precipitates neither tannin nor tartar emetic, but is precipitated by subacetate of lead.

The *tannic acid, cincho-tannic acid,* or *soluble red colouring matter* of Pelletier and Caventon, has all the properties peculiar to this principle. It has a brownish colour, an austere taste, is soluble in water and alcohol, precipitates metallic oxides, and forms precipitates with the salts of iron, varying with the barks, being deep green with the pale, blackish-brown with the yellow, and reddish-brown with the red.

The most interesting constituents of the Cinchonas are the cinchonia, quina, and quinidine, and the acid with which they are associated.

Cinchonia is a white crystalline substance, soluble in 2500 parts of boiling water, almost insoluble in cold water, very soluble in boiling alcohol, slightly soluble in ether. Its bitter taste is at first not very obvious. Its solutions have it more so. It has a strong alkaline reaction, neutralizing acids, forming compounds with sulphuric, nitric, hydrochloric, phosphoric, and acetic acids, very soluble in water, but less soluble compounds with tartaric, oxalic, and gallic acids. It may be procured by boiling the pale bark in very dilute sulphuric acid, then adding lime to super-saturation, collecting the precipitate, and digesting it in boiling alcohol; on cooling and evaporation the cinchonia will be left. It is considered to be a compound of—

20 carbon	20 × 6 =	120
12 hydrogen	12 × 1 =	12
1 oxygen	=	8
1 nitrogen	=	14
		154

Formula $C^{20} H^{12} ON$.

Brande, a German chemist, does not admit any oxygen in its composition.

Quina is whitish, flocculent in its appearance, and does not crystallize like cinchonia; with care it appears that it may be procured in pearly silky needles. It is fusible like resins, and becomes brittle on cooling; it is more bitter than cinchonia, almost insoluble in water, but very soluble in alcohol, and also in ether. It unites with acids readily, forming compounds similar to those of cinchonia. It is unalterable in the air. Its composition, according to Pelletier and Dumas, is the following:

Carbon . . .	20	20 × 6 =	120
Hydrogen . .	12	12 × 1 =	12
Oxygen . . .	2	2 × 8 =	16
Nitrogen . . .	1	=	14
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It may be procured from the disulphate by precipitating it with an alkali; or from the bark by a process like that for procuring cinchonia.

Quinidine, a third alkaloid, is now used medicinally, and is found in many of the cinchonas, and is obtained by a similar process as is adopted for obtaining quina when pure; its crystals are anhydrous, colourless prisms, with a vitreous lustre. It is sparingly soluble in water, soluble in about twelve parts of alcohol, less so in ether. It does not produce a green colour when treated with chlorine and ammonia. Its salts are more soluble in water than those of quina; with sulphuric acid it forms a sulphate and bisulphate. Its formula is $C^{36} H^{22} O^{2} N^{2}$. A fourth alkaloid has been found by Pelletier or Coriol, named *Aricina*, but it is not admitted by more modern chemists.

A substance named *Amorphous* Quinine is obtainable from the Cinchona barks, but its precise nature is not agreed upon; some consider it to be uncrystallizable Quina, others view it as a combination of Quina, Cinchona, Quinidine, and some resin, and to this the term *Quinoidine* has also been applied. Another distinguished chemist, named Pasteur, asserts that there are four distinct alkaloids in the Cinchonas, to which he gives the names of Quinine, Quinidine, Cinchonine, and Cinchonidine.

Kinic acid is obtained by treating a watery extract of cinchona with alcohol, which leaves a viscid mass, consisting of kinate of lime. This is dissolved in water, and is treated with oxalic acid, which unites with the lime and falls, leaving the acid in solution, which by evaporation can be procured in crystals. It is very soluble in water, has a sour taste and acid reaction, unites with alkalies, forming very soluble compounds. It is composed of 15 carbon, 10 hydrogen, and 10 oxygen.

Kinovic acid is found in some of the barks, and is supposed to be combined with lime. It is a white amorphous substance, soluble in ether and alcohol, but almost insoluble in water.

In speaking of incompatibles with cinchonas, many things are mentioned which no one ever thinks of prescribing with them. We should particularly avoid compounds containing tartaric, oxalic, gallic or tannic acids, tartar emetic, and metallic salts generally.

Medical Properties.—Cinchona has long been, and still is found to be, a most valuable remedy. It is tonic, febrifuge as regards intermittent fevers, generally astringent, although in some persons it has a purgative action. Its operation is more that of a stimulant than sedative, and consequently it is not adapted to acute inflammatory diseases.

When cinchona is taken into the stomach it excites a sense of warmth in the epigastrium, which diffuses itself over the chest and abdomen; sometimes this is attended with gastric and intestinal irritation, amounting to vomiting, and even purging. After some time the pulse is accelerated, and there is a feeling of excitement in the whole body. Its action on the nervous system is evinced sometimes by a sense of pain or tension about the head, singing in the ears, and even deafness, which are very distressing to some individuals.

The most remarkable effect of this bark is its influence upon periodical diseases, the morbid chain of which it appears to break, independent of any sensible impression to which we can refer its operation; for which reason the term anti-periodic would be applied to it with propriety. It may generally be used where we wish to produce a permanent corroborant effect, and when the stomach is in a condition to admit of its administration. It is contra-indicated in high inflammations, or in plethora, determination of the blood to the head, in irritation of the stomach, or where the secretions are locked up. It is valuable in low typhoid states of disease, in which the inflammation has been subdued by proper measures, or the suppurative process has commenced somewhere; thus it is serviceable in low typhoid fevers, scarlatina maligna, small-pox, erysipelas, carbuncle, and most diseases in which there are copious purulent discharges, and a tendency of the disease towards recovery. As a tonic it is prescribed in most diseases of debility and of a chronic nature, such as scrofula, passive hæmorrhages, some forms of dyspepsia, obstinate skin affections, chorea, hysteria, and chronic rheumatism.

In intermittent fever, cinchona is our best remedy and main dependence. It may be administered in various forms according to the age and constitution of the patient. The disulphate of quinine has superseded all others on account of the facility of administering it, and the greater certainty of its action. In agues, it should be given soon after the paroxysm is terminated, and repeated several times during the intermission. In a quotidian, the dose might be two or three grains every second hour; in the tertian and quartan ague, as there is a longer interval, it need not be repeated so often. Some prefer giving a single large dose, as ten to twenty grains of the disulphate, a short time before the paroxysm. There are favorable reports of each method. It should always be provided that the stomach and abdominal viscera have received due attention, for, if the liver is in a congested state, and the secretion in it is not properly performed, all remedies will be unavailing; but as soon as they are treated in a proper manner, the quinine will often act like a charm. If the powdered bark be preferred, it may be given in repeated doses of from one to three drachms during the intermission, so that the quantity taken in that time may amount to one ounce and a half to two ounces.

The estimated relative strength of disulphate of quinine to powdered bark, is one grain and a half to one drachm. The powder is most agreeably taken in a quantity of milk.

Cinchona does not benefit intermittent fevers alone, but also other diseases having an intermittent or remittent nature, especially if neuralgic; as hemicrania, neuralgia of the eye, face, and other parts of the body, some cases of epilepsy, dysentery, and remittent fevers after depletion.

The variety of bark, most likely to benefit, is not agreed upon by all. The quilled bark enters into several preparations of the Pharmacopœia, but the sulphate of cinchonine procurable from it is scarcely ever prescribed. This, I believe, does not arise from a supposed inefficiency of it, but, from use having established the grand virtues of the salts of quina, the other has been neglected, and would be a more expensive remedy. In the form of powder, the red bark is certainly best, as it contains most active matter. The pale bark appears to be least offensive to the stomach, and less irritant to the bowels. How does cinchona act as a purgative? this question is not easily solved. When given in powder, it has been imagined that the minute particles mechanically irritate the mucous membrane, and cause it to throw out more fluid; yet the disulphate of quina in solution will do the same. When it purges, it is generally in persons of a lax delicate fibre: in such, probably, it operates by giving tone to the muscular coat, increasing peristaltic action, and giving energy to the vascular and secreting systems.

The forms in which bark is administered are numerous, consisting, in addition to the powder and disulphate of quina, of the infusion, decoction, extract, and tinctures; and it has even been proposed to bring the system under its influence, by introducing it by an abraded surface, or applying it to the whole body in the form of baths. It has also been woven in substance into garments, to be worn next to the skin.

The powder is generally most efficacious, when we wish to make a speedy and powerful impression, and should be tried in intermittents, if the disulphate of quinine fails.

The disulphate of quina is the most valuable form, and may be given for almost every case in which cinchona appears to be indicated, and possesses the advantage of being condensable into the small form of a pill.

The infusion or decoction may be given to persons of weak stomach, in convalescence after long diseases: with them we often combine dilute sulphuric acid.

The extracts are generally not good forms for administering cinchona, and they are very little prescribed.

The tinctures are seldom used alone, but as adjuncts to tonic infusions.

Should any of the preparations have a tendency to run off by the bowels, we should combine them with oak-bark or other astringents, and sometimes opium.

Doses.—Of the powder, ʒss to ʒiij.
Infusion of decoction, ℥j to ℥ij.
Extracts, gr. x to gr. xv.
Of the Tinctures, ʒj to ʒiij.

Prep.—Quinæ Disulphas,—Decocta Cinchonæ Flavæ Pallidæ et Rubræ,—Extracta Earundem,—Inf. Cinch. Pallidæ,—Tinct. Cinchonæ,—Tinct. Cinch. comp.,—Inf. Cinchonæ Spissatum.

CINNAMOMI CORTEX ET OLEUM.

The bark and oil of the CINNAMOMUM ZEYLANICUM, *alias* LAURUS CINNAMOMUM.

The cinnamon tree grows to the height of twenty to thirty feet, with a trunk from twelve to twenty inches in diameter. It has numerous branches, strong, horizontal, and declining. From the root spring numerous suckers, which form a bush about the tree. It is a native of Ceylon, and is cultivated in many other parts of Asia. The tree emits no perceptible odour at any distance. The bark of the root has the odour of cinnamon with the pungency of camphor, which it yields by distillation. The leaves have a spicy odour, and a hot taste. The petiole has the flavour of cinnamon. It is the prepared bark which is so highly valued as a drug.

Cultivation.—In Ceylon, the seeds are planted in a prepared soil at a certain distance, and the plants usually grow in clusters like the hazel bush. They attain a height of five or six feet in six or seven years, and a healthy bush will then afford two or three shoots fit for peeling; and every second year will continue to produce about five or seven shoots. The shoots which are selected for decortication are one to two inches in diameter. The bark of them is cut with longitudinal incisions, made opposite to each other, and removed by suitable instruments. The pieces are then collected into bundles, and allowed to remain some time, during which a fermentation ensues, that facilitates the removal of the cuticle. The epidermis and green matter under it are removed by scraping it upon a convex piece of wood. The bark now dries and assumes a quilled appearance. These cylinders are then packed one within another, and collected into bundles, in which form the drug is usually imported. Some of the inferior bark is exported to the continent of India, or employed for procuring the volatile oil.

Ceylon cinnamon is in long quilled pieces, the larger enclosing smaller ones. It is of a light brownish-yellow colour, very thin, smooth, shining, with a splintery fracture when broken. It has a fragrant odour, a warm, aromatic, pungent, and agreeable taste. By distillation it affords a very fragrant volatile oil.

Its constituents are—

Essential oil; tannin; mucilage; colouring matter; acid; starch; lignin.

Medical Properties.—A warm stimulant aromatic; useful in cases which require such remedies. It is also astringent. It is seldom, however, prescribed, except in combination with other aromatics, or as a corrective.

Prep.—Conf. Aromat.,—Inf. Catechu comp.,—Pulv. Cinnamomi c.,—Pulv. Cretæ c.,—Pulv. Kino comp.,—Sp. Ammon. Arom.,—Spir. Cinnamomi,—Tinct. Cinnam. c.,—Tinct. Catechu,—Tinct. Lav. c.,—Vin. Opii.

COCCUS.

Cochineal.—COCCUS CACTI; the cochineal insect belongs to the genus of Hemipterous Insects, having the snout, or rostrum, in the breast, the antennæ filiform, and the posterior part of the abdomen furnished with bristles. The male has two erect wings, the female is wingless. The coccus cacti is known by its depressed, downy, transversely wrinkled body, its purplish abdomen, short black legs, and subulate antennæ, about one third the length of the body. This insect is found abundantly in Mexico and neighbouring country, where it feeds and propagates upon a species of cactus named *Opuntia* Cochinillifera. The female insects only are used; they are detached from the plants by a blunt knife, and are destroyed either by dipping them into boiling water, or by heating them in a stove. These insects are collected three times in a year, being the produce of three distinct generations. There are two varieties of cochineal in the shops, known as *silver grain* and *black grain;* the former obtains the highest price. Cochineal has a faint odour, and a bitter, rather acidulous, taste; its powder is of a carmine colour, and tinges the saliva intensely. According to Pelletier and Caventon, it yields on analysis—

A colouring principle, named *carmine;* a peculiar animal matter; fatty matter; an odorous fatty acid; various salts.

The colouring principle has been named by John, *Cochinilin.*

Carmine is soluble in water, cold and hot alcohol, insoluble in ether: the watery solution of carmine is brightened by acids, and deepened by the alkalies. The salts of tin, especially the nitrate and muriate, precipitate this colouring matter of a brilliant scarlet, forming the basis of those scarlet and crimson dyes which have rendered cochineal so valuable in the arts. With alumina it forms the pigment called *lake;* the pigment named *carmine* is the colouring matter of cochineal, precipitated from the decoction by acids, the salts of tin, or animal gelatin.

Medical Properties.—Cochineal has been reputed to be anodyne and antispasmodic: but such qualities do not belong to it. It is only of service in pharmacy as a colouring matter. The chief disease in which it is prescribed in the present time is hooping-cough, in combination with carbonate of potash. The latter probably alone does good by attenuating the mucus, and causing it to be brought up with greater ease.

Prep.—Tinct. Card. comp.,—Tinct. Cinch. comp.

COLCHICI CORMUS ET SEMINA.

The Cormus and Seeds of COLCHICUM AUTUMNALE. *Meadow Saffron.*

This plant is indigenous, and likewise grows in many other European countries. It was known to the Greeks, and was named by them Hermodactylus. Its growth is very peculiar. A bulb is formed during the summer; from this a flower shoots up in the autumn, and is followed in the ensuing spring by the leaves and the seed-vessel. The same bulb, or cormus, is able to produce flowers during two seasons. The parts of the plant which are active are the flowers, seeds, and cormus; the latter two only are officinal. The seeds are ripe and fit for collecting in June and July, and at about the same time the cormus should be dug up: in fact, at that period the decaying leaves and dry capsule serve to indicate the locality of the cormus. The cormus cannot be preserved very long in a moist state, but carefully dried and prepared it preserves its virtues for some time. To do this, it should be cut into slices of the thickness of half-a-crown, placed separately on paper, and be dried with a gentle heat. If cut transversely, they should not have a depression in two parts of the circumference, as that indicates bulbs of two years' growth, which are less active as medicinal agents. The seeds require no particular care, as they preserve their virtues without any preparation for some years. The active principle resides in the coverings, and is extracted without the necessity of bruising them; such a preparation is more transparent and elegant, and equally efficacious. Colchicum varies considerably in its strength, according to localities and climates; for it is said, that in Carniola, the peasants use it as food with impunity.

Its constituents, according to Pelletier, are—

Veratria, combined with gallic acid; fatty matter; yellow colouring matter; gum; starch; inulin, in large quantity; lignin.

The active principle, named above Veratria, is now considered to be a distinct alkaloid, and is called by some German chemists Colchicia, which appears to differ from veratria in many respects, for it is soluble in water, crystallizable, and does not excite sneezing when applied to the nose.

Medical Properties.—Colchicum is purgative, diuretic, sedative, and sometimes diaphoretic. The diseases in which it is most useful are gout and rheumatism, which it has the power of relieving in a most marked manner. Considerable difference of opinion exists about the *modus operandi* of this substance. Some contend that it never does good till it purges, and acts freely on the kidneys; and they are not satisfied till the alvine evacuations assume an appearance resembling green pea-soup. Others consider that it has a specific action, independent of such effects. Some say that it acts by causing revulsion, that is, by irritating and determining a large quantity of blood to the mucous membrane of the intestines, and relieving the loaded vessels of the inflamed parts: others assign to it a chemical operation on the principles of the humoral pathologists; they find that it causes a considerable excretion of uric acid, which was previously deficient in the urine, and present (where it should not be) in the blood; and in proportion as this remedy acts, the uric acid disappears in the blood, and becomes more plentiful in the urine.

From my own observation and experience, I am convinced that colchicum possesses a sedative influence, and some specific action, which tranquillises the nervous system, allays pain, and lowers the pulse, independent of its purgative and diuretic qualities; and, to prevent purging, I have sometimes combined it with astringents, and with the best effects. There is no doubt that when it purges the pain will be less felt, because its operation is much more violent, which, in some cases, may be necessary from the urgency of the symptoms. In large doses it causes nausea, and sometimes vomiting; in the duodenum, it appears to occasion a more free discharge from the ductus communis choledochus: it increases also the secretion of mucus and serum in the intestinal canal; and if the dose be unwarrantably large, bloody evacuations will result. To check these, hydrocyanic acid is very efficacious, or opium with camphor, followed by mucilaginous drinks. Besides gout and rheumatism, it is given advantageously in many inflammatory diseases, especially when occurring in a rheumatic habit. It is also serviceable in orchitis and gonorrhœa.

Dose.—Of the powdered cormus, gr. iv to gr. vj.
Vinum ♏xx to ʒss, ter die.
Tinct. Colchici, ʒss.
Tinct. Colch. c., ʒss.
Acetum Colchici, ʒss to ʒij.
Extr. Colch. Acet., gr. j to gr. iij.

Prep.—Acetum Colch.,—Extr. Colch. Cormi,—Extr. lch. Acet.,—Tinct. Colchici,—Tinct. Colchici c.,—Vin. lchici.

COLOCYNTHIS.

The dried pulp of the Pepo of CITRULLUS, or CUCUMIS LOCYNTHIS. *Bitter Cucumber.*

This plant is an annual, having a considerable resem- nce to the common cucumber, excepting the fruit, which mediately distinguishes it. It is a globular berry, or po, of the size of an orange, yellow, and smooth when e; and contains, within a hard coriaceous rind, a white ongy matter, surrounding numerous ovate compressed ds.

It is a native of Turkey, and abounds in the islands of Archipelago. It grows also in several parts of Africa d Asia. At the Cape of Good Hope the young fruit, in ich the bitter principle is not yet developed, is said to much used in the form of a pickle. The drug is iefly imported from the Levant.

The seeds of colocynth, which form nearly three quar- s of the weight of the dried pepo, are devoid of active operties, and are even used as food in some parts of rica. The pulpy or medullary matter only is used. is has a feeble odour, but a nauseous, intensely bitter te. The bitter principle has been separated, and named locynthin. According to Meissner, 100 parts contain—

Colocynthin	14·4
Extractive	10·
Fixed oil	4·2
Resinous substance, insoluble in ether	13·2
Gum	9.5
Pectic acid	3·5
Gummy extract	17·6
Phosphate of lime	2·7
„ of magnesia	3·
Lignin	19·
Water	3·4

The active matter of colocynth is taken up by boiling water, which, on evaporation, affords the extractum colocynthidis.

Medical Properties.—A powerful drastic purgative. It is too violent in its action to be given alone, for it is likely to produce vomiting, bloody discharges, and inflammation of the bowels. Combined with other purgatives, it is a very useful remedy. The form in which it is most used is the compound extract of colocynth, which, with calomel, forms one of our most common purging pills. To prevent the griping which may be produced by it, some aromatic oil may be added, or about five grains of extract of henbane, which will prevent the griping without diminishing the purgative operation.

Dose.—Of Colocynth, in powder, gr. ij to gr. v.
Of the Pil. Coloc. comp., gr. x to gr. xv.

Prep.—Extr. Col.,—Pil. Colocynth. comp.,—Enema Colocynthidis.

CONII FOLIA ET FRUCTUS.

The leaves and fruit of the CONIUM MACULATUM. *Spotted Hemlock.*

This herbaceous plant is a native of Europe, growing very freely in most parts of this country. It is characterised by its spotted stem, tripinnate leaves, an involucre, consisting of from five to seven leaflets, the involucella of three, placed on one side, and the fruit having five ridges, with crenated margins. The leaves and fruit are officinal.

Much of the activity of this plant depends upon soil and climate. In northern latitudes it is very mild, so that in some parts of Russia it is eaten freely with impunity; whereas in Italy, Greece, and Spain, it is poisonous, in comparatively small quantities. The leaves should be gathered just about the time that it begins to flower; they should be separated from the petiole, and carefully dried with a gentle heat, and then be preserved in vessels, from which moisture, air, and light are excluded.

Properties.—The dried leaves have a strong, heavy, narcotic odour, and a nauseous, rather bitter taste: their powder has a fine green colour. Water distilled from them possesses their odour, and has a nauseous taste, but no narcotic qualities. The decoction has little taste, and the extract afforded by evaporation is almost inert. Alcohol and ether take up the narcotic properties of the leaves; and an ethereal extract prepared from them is exceedingly powerful. The analysis of this plant is rather imperfect. Schrœder found in it—

Resin; extractive; gum; albumen; a green fecula; various saline substances.

Besides these, Brande discovered a very odorous oil, and an alkaline principle, possessing a strong narcotic smell and a nauseous taste, insoluble in water, and in doses of half a grain producing dangerous symptoms. This is named *conia* or *conein*. Geizer has obtained an alkaline principle in the form of a volatile liquid, which is of a yellowish colour, has a strong nauseous taste, and an odour somewhat resembling hemlock and tobacco; it is sparingly soluble in water, and has a strong alkaline reaction, neutralizing acids, uncombined, in the form of salts: it is actively poisonous.

Formula of Conia $C^{17} H^{17} N$.

Medical Properties.—It is anodyne and narcotic, without any decided sedative or stimulant action. If given in sufficient doses, it shows its effects in about half an hour after being taken. It appears to act by diminishing the sensibility of the nervous system, and by allaying irritation in various parts of the body suffering from disease. Hence it is serviceable in most inflammatory pulmonary diseases, especially of a chronic nature, such as asthma, bronchitis, hooping-cough, phthisis, chronic enlargement of the liver, and other abdominal viscera; painful scrofulous tumours, and ulcers; some diseases of the skin; secondary syphilis, rheumatism and gout, and had formerly much reputation in the treatment of cancer, in which now it is believed to be only a palliative remedy.

The effects of it in large doses are, vertigo, dimness of sight, nausea, faintness, and general muscular debility. In still larger doses, it occasions dilated pupil, difficulty of speech, delirium or stupor, tremors, paralysis, convulsions, and sometimes death. The curative treatment in such cases would consist of the administration of tonic emetics, diffusible stimulants, and nervous excitants. It is administered in the form of powder, which is best; also in tincture and extract.

The dose requires to be increased more rapidly than with most other narcotics, although at first it is given with moderation; and it is desirable that the remedy should not be procured from different places or persons, as it varies much in its strength.

Dose.—Of the powder, gr. ij, gradually increased to gr. xv.

Of the extract, gr. iv to gr. xv.

Prep.—Extr. Conii,—Catapl. Conii,—Pil. Con. c.,—Tinct. Conii,—Unguentum Conii.

COPAIBA.

The liquid resin of the COPAIFERA MULTIJUGA, and other species.

The tree which affords this substance is not agreed upon by writers on Materia Medica; it was considered to be the *C. Langsdorfii* in the former Pharmacopœia. The balsam is most abundantly collected in the province of Para, in Brazil, and is exported from the port of Para, in small casks or barrels. It is obtained by making deep incisions into the stems of the trees; and the operation is repeated several times during the season. When it flows out, it is clear, colourless, and very thin; but soon acquires a thicker consistence and a yellow tinge.

Properties.—It is a clear, transparent liquid, of the consistence of olive oil, of a yellowish colour, a peculiar, not very unpleasant odour, and a bitterish, not nauseous taste. It is insoluble in water; but entirely soluble in alcohol, ether, fixed and volatile oils. With the alkalies it forms saponaceous compounds, soluble in water. It consists chiefly of volatile oil and resin, with a minute proportion of acid, which resembles acetic, and has been named copaivic acid. The volatile oil, which forms about a third, may be separated by distillation. It is at first almost colourless, but the latter portion has a greenish-blue colour. By redistillation it may be obtained almost colourless. It appears to contain no oxygen, as potassium can be kept in it. The remaining resinous mass is brittle, of a greenish-brown colour, and almost devoid of smell and taste. This is capable of being separated into two substances, distinct from each other.

Copaiba on exposure to the air acquires a thicker consistence and deeper colour, partly from the volatility of the oil, partly from the essential oil being oxidized. When triturated with about one sixteenth of its weight of magnesia, and set aside, it gradually assumes a solid consistence, by which it can readily be given in the form of pills. Copaiba is said to be sometimes adulterated with the fixed oils, castor-oil especially, and oil of turpentine. The latter can be known readily by its smell; the others by boiling the liquid in water, which, on evaporation, if the copaiba be pure, will leave a solid residue, instead of a soft unctuous substance; also strong liquor ammoniæ will scarcely make copaiba turbid, but would give it a milky appearance, if oils be mixed with it.

Medical Properties.—Gently stimulant, diuretic, and sometimes actively purgative. It produces a warm sensation in the fauces and stomach, and its irritant effect extends not only through the alimentary canal, but likewise to the urinary passages, and in a less degree to the other mucous membranes, on which it appears to possess a peculiar action. It gives an unpleasant odour to the breath, and also to the urine. As a remedy it is most efficacious in chronic affections of mucous membranes, as in gleet, leucorrhœa, chronic dysentery, painful hæmorrhoidal affections, chronic catarrh, and bronchitis. Gonorrhœa is the disease in which it is most used, and by some in every stage of it; the periods after the active inflammation has subsided are most fitted for its use. In some persons it occasions painful irritation of the urinary passages, inflammation of the testicles, and occasionally an unsightly papular eruption over the whole body.

There are various modes of giving it; such as, dropped on a piece of sugar: by the French pharmaciens it is now enclosed in capsules made of gum, and thus conveniently swallowed, without being tasted. It may be made into a species of emulsion, by triturating it with some powdered gum acacia, or the yolk of egg, with syrup of tolu added, and subsequently water; thus suspended it is swallowed readily. The oil may be taken in a similar manner. The resin is almost inert and useless.

Dose.—ʒss to ʒij.
Of the Oil, ♏x to ♏xxx.

The modus operandi of this and similar remedies is not quite clear. It may stimulate the mucous membrane, and cause a change in the action of its vessels, by actual contact of part of its constituents, through the medium of the blood; or the vessels of the membranes, which it does not touch, may be affected by sympathy with those to which the copaiba is actually applied; this is rendered probable by the fact, that when the medicine is most beneficial there is a peculiar sensation of warmth felt in the lower part of the intestinal canal. Others imagine that it acts by revulsion, that is, by determining blood to other surfaces or parts of the body.

CORIANDRUM.

The fruit of Coriandrum Sativum.

This plant is an annual, a native of Italy, but now growing freely in most parts of Europe. The fruit, which is officinal, consists of two concave hemispherical seeds, adhering together in a spherical form.

The seeds have an aromatic smell and taste, depending on a volatile oil, which can be separated by distillation. The virtues are imparted to alcohol, less perfectly to water.

Medical Properties.—These seeds are aromatic and carminative, useful, like others of their class, as an adjunct and corrective of other substances. They have no particular virtues to recommend them.

Dose.—Gr. xx to gr. xxx.

Prep.—Conf. Sennæ.

CORNU.

The horn of the Cervus Elaphus. *Stag* or *Hart.*

This substance is usually kept in the form of shavings, known as Hartshorn Shavings. They are without smell or taste, pliable, and of a white colour. They contain in 100 parts—

Gelatine (keratine)	27
Phosphate of lime	57·5
Carbonate of lime	1·0
Water and loss	14·5

Boiling water extracts the gelatine, which on cooling forms a transparent colourless jelly, that may be rendered palatable by lemon juice, wine, &c. There is, however, commonly, rather an unpleasant odour combined with it, which is the cause of its being little used for that purpose. By destructive distillation these shavings yield an impure solution of carbonate of ammonia, named *spirits of hartshorn*, which name is also given to a similar liquid obtained from other sources. When burnt, the residue is principally phosphate of lime.

Medical Properties.—The jelly may be taken as nutritive and demulcent. The chief use of the substance is, in pharmacy, in making pulvis antimonii compositus.

Prep.—Pulv. Ant. comp.

CREASOTON.[1]

Creasote, prepared from pyroxylic spirit.

Creasote, when pure, is a colourless liquid, of a thin, oily consistence, possessing a strong odour, and powerful pungent taste. Its odour is likened to wood smoke, or smoked meat. It boils at 397° F. Its specific gravity is 1·037. Water dissolves about one part in 80. It is very soluble in alcohol, ether, naphtha, and acetic acid; has no acid or alkaline reaction, but combines with both acids and alkalies. It forms compounds with soda, potash, and lime, soluble in water; and may be separated from them by very feeble acids. It is decomposed by nitric and sulphuric acids. It coagulates albumen readily, and in a very diluted state. It acts powerfully on living beings, destroying them if brought in contact with it, even in a very diluted form. It is composed of oxygen, hydrogen, and carbon, but in proportions which are not agreed upon. Its name explains a remarkable property which it possesses, viz. its antiseptic power upon flesh. The word is derived from the Greek, being formed of κρεὰς, *flesh*, and σωζω, *I preserve*.

Creasote is an ingredient of tar, procured from vegetable and some animal substances; most generally it is obtained from the impure pyroligneous liquid which is evolved by the destructive distillation of wood. In this liquid, in addition to creasote, we find five other principles bearing some relation to it; these are. paraffine, eupione, pittacal, picamar, and capnomor. The heaviest tarry liquid is selected for the purpose, and treated with carbonate of potash, and distilled. The oily liquid is then mixed with a strong solution of potash, which combines with the creasote, allows the eupione to collect on the surface, and decomposes other organic matters. It is then decomposed by sulphuric acid, which sets free the creasote, and this is collected by distillation. To procure it pure, the above process must be repeated several times. The best method of obtaining this liquid is described minutely in the chemical work of. M. Dumas, to which the curious reader is referred.

Medical Properties.—The virtues of creasote in the cure of disease are not satisfactorily established. It has often held out great hope and promise, which a short period of trial has completely overthrown. It is a decidedly powerful remedy in toothache, if introduced into a carious tooth. It sometimes checks obstinate vomiting, when all other remedies have failed. Amongst the numerous diseases in which it has been tried, are hæmoptysis, diabetes, burns, itch, and several skin diseases; gangrene of the extremities, scrofulous ulcers of the throat and leg; syphilitic sores, lumbago, aphthæ, and rheumatism. For months and even years no cases have been particularly recorded in our periodicals; the inference is, that it has deceived the expectations of its early admirers, and that it is about to share the fate of many other panaceas.

The action of creasote on the system is very mysterious; for it seems to be both a sedative and stimulant, in different cases and doses, and it probably acts in part by its chemical action upon the tissues, to which it is applied. Thus, it checks the bleeding from vessels by the coagulation produced in the blood. From experiments on animals, in large doses, it has been observed to occasion sudden prostration of muscular power, vertigo, oppression of the breathing, vomiting, spasms of the abdominal muscles, tremors, convulsions, and 'death. On examination after death the tissues possess the odour of creasote, the large vessels about the heart are gorged with blood more coagulated than usual, there is congestion of the lungs, but little congestion of the vessels of the brain. It is also found to produce an inflammatory appearance of the mucous membrane of the alimentary canal. Creasote may be given in the form of liquid or in pills. The latter is more pleasant, as the taste of creasote is far from agreeable.

Dose.—One minim three times a day, which may be gradually increased to eight or ten minims.

As an external application in the form of lotion, two to eight drops of this liquid may be added to each ounce of water.

CRETA PRÆPARATA.

CARBONAS CALCIS FRIABILIS. *Prepared Common Chalk.*

Carbonate of lime is one of the most abundant minerals, occurring in other forms besides chalk, such as marble, calcareous spar, common and shell limestone, and marl. It also occurs in the animal kingdom, forming the chief part of the shells of animals. Though insoluble in water, it is present in most springs, dissolved by carbonic acid. It can be detected by heating the water to expel carbonic acid, when it is precipitated, or by adding oxalic acid, which immediately forms an insoluble white oxalate of lime. Besides the form of chalk, carbonate of lime is made officinal in Pharmacopœias, as it exists in marble, oyster-shells, crabs' claws, and stones, &c. Chalk is a compound of

1 carbonic acid = 22
1 lime = 28
—
50

Formula CaO, CO^2.

For medical purposes chalk requires to be purified and reduced to a very fine powder: this is effected by elutriation. This process consists of powdering the chalk, and rubbing it with a little water, then throwing it into a large quantity of water and stirring them together briskly. After a few minutes the turbid supernatant liquid is to be poured off into another vessel and allowed to stand, in order that the chalk may fall in a minutely divided state.

Medical Properties.—Chalk is antacid and indirectly astringent. It is chiefly used in diarrhœa, in which it appears to act by neutralizing free acid, and thus allaying irritation. It is often employed externally for burns and ulcers as an absorbent. It prevents the discharge coming in contact with the healthy part, and possibly benefits by the action of lime, or by the carbonic acid which may be set free.

Dose.— Gr. x to gr. xxx.

Prep.—Acid. Tart.,—Calc. Chloridum,—Creta Præparata,—Hyd. c. Creta,—Mist. Cretæ,—Pulv. Cret. comp., —idem cum Opio.

CROCUS.

The stigma of the Crocus Sativus. *Saffron.*

This crocus is a bulbous plant, sending up its flowers in September and October. The flowers are of a lilac or bluish-purple colour. The pistil is surmounted by a stigma which is three cleft; the segments of a beautiful rich orange colour hanging down between and over the petals of the corolla. The stigma is the officinal portion. This plant is a native of Greece and Asia Minor, but is now cultivated in Spain, Sicily, France, and England, and indeed in other parts of Europe. The stigmas are carefully collected and dried, and are compressed sometimes into a flattened mass, forming the cake saffron. The dried stigmas form the *Crocus in Fœno* or hay-saffron; one pound of dried saffron is obtained from five of the moist. The substances used to adulterate this drug are the Carthamus Tinctorius, the Calendula Officinalis, or Common Marigold, and fibres of dried beef. These are easily detected, by exposing the drug to the action of hot water, when the different forms of the impurities will be easily detected. The cake saffron is generally very impure, and, as sometimes met with, does not contain a particle of crocus.

Properties.—It has a sweetish aromatic odour, a warm pungent bitter taste, and colours the saliva deeply. It contains an extractive matter, named Polychroite, odorous volatile oil, wax, gum, albumen, some saline matter, and vegetable fibre.

Medical Properties.—Saffron is of no essential service as a medicine. It would act as a stimulant in large and inconvenient doses. We use it on account of the colour which it gives to many preparations. It is a popular practice to give saffron to children in the inflammatory exanthemata, with the idea of throwing out the eruption. If given to them in very small quantities it can be of no use, and if given largely it may produce mischief.

Prep.—It enters into several tinctures, powders, and pills.

CUPRI SULPHAS.

SULPHATE OF COPPER. *Blue Vitriol.*

This substance is found native in small quantities, and is prepared artificially for medical use. It may be made by the direct union and action of sulphuric acid upon metallic copper, or by roasting the sulphuret, which by the oxygen of the air forms a sulphate. This is separated by lixiviation, and by evaporation is procured in crystals. Sulphate of copper has a beautiful blue colour; it crystallizes in rhomboidal prisms, which effloresce slightly in the air; it is soluble in four parts of cold and two of boiling water.

It is composed of—

1 oxide of copper		= 40
1 sulphuric acid		= 40
5 water	5 × 9	= 45
		125

Medical Properties.—Tonic, astringent, and emetic; externally, astringent and escharotic. Internally it is serviceable in diarrhœa, hæmorrhage, chronic dysentery, and to check the excessive discharges in cholera, in chorea, epilepsy, and in intermittent fevers. As an emetic it is prompt in its operation, but is not always freely evacuated, and, besides, oftentimes causes very unpleasant irritant symptoms, and is better replaced by sulphate of zinc. It is a tonic and direct emetic, that is, acting speedily, and not leaving nausea or depression after its action. The cases most suited for its use are those of poisoning, especially by narcotics.

Externally it is used as a collyrium in the proportion of one to three grains to an ounce of water: most commonly in purulent ophthalmia. It is usefully applied to warty excrescences and fungous granulations, upon which it partly exerts a chemical action, and partly destroys by constringing the vessels of the part, thus cutting off their necessary supply of blood.

Dose.—As a tonic, gr. ss, increased gradually to gr. ij; as an emetic, gr. v to gr. xv.

Prep.—Cupri Ammonio-Sulphas.

CURCUMA.

The root-stock of Curcuma Longa. *Turmeric plant.*

This plant is a native of the East Indies and Cochin-China, and is cultivated in various parts of Southern Asia, especially Bengal and Java. The rhizome only is officinal. It is in cylindrical pieces of about the thickness of a finger, and from one to three inches in length, externally yellowish-brown, internally of a deep orange colour, hard, compact, and breaking with a fracture resembling wax. The odour is peculiar, the taste warm, bitterish, somewhat aromatic. It tinges the saliva yellow, and affords an orange-yellow powder. Pelletier analysed it and found in it—

Lignin; starch; a yellow colouring matter (Curcumin); brown colouring matter; gum; an odorous, acrid, volatile oil; chloride of calcium.

The peculiar colouring principle is reddish-brown in a concrete state, yellow when minutely divided, slightly soluble in water, very soluble in ether, alcohol, and oils. The alkalies immediately convert it to a red-brown colour, and paper coloured with it is used as a test of them. It is used in yellow dyes, but the colour is not permanent.

Medical Properties.—It is stimulant and aromatic, and might be used in the same cases as ginger. It is much used in India as a condiment, and is a general ingredient in the Curry powder. With us it is employed chiefly as a test of alkalies, or as a colouring matter in ointments and other preparations.

CUBEBA. (*Vide* Piper Cubeba.)

CUSPARIA.

The bark of the Galipea Cusparia?

It is said also to be from the Cusparia Febrifuga, or Bonplandia Trifoliata, and is likewise known by the term Angustura bark.

This tree grows in the mountains of Carony, and attains an elevation of from ten to twenty feet. The bark of it only is officinal. It is commonly imported from the West Indies.

It is in pieces of various lengths, some quilled, others rather flat, with thin edges, as if removed by a sharp instrument. Its outside is gray, with a pale wrinkled epidermis. It is brittle, but softens in water, so as to admit of cutting with much ease. Its taste is bitter, and slightly aromatic. The proximate principles are chiefly—

Volatile oil; bitter extractive; hard bitter resin; soft resin; gum; lignin; various salts.

It imparts its virtues to water and alcohol.

A false Cusparia is spoken of by writers on Materia Medica, as necessary to be distinguished from the true species. This drug, known some years since in Europe, has almost entirely disappeared, for a specimen can scarcely now be found in any shop in this country, and probably in any part of Europe; neither has the tree been known from which it was procured. It is said to be distinguished by its dark rusty brown rugous surface, dark colour inside, splintery fracture, not softening by water, want of odour, and intensely bitter taste; by nitric acid dropped upon it, causing deep blood-red spots, and emerald green upon the epidermis. In true Cusparia, this acid causes a dull red colour on either surface. The spurious Cusparia was found to contain *brucia*, and is believed by Dr. Pereira to have been the bark of strychnos nux vomica.

Medical Properties.—It is a stimulating tonic, and in large doses somewhat aperient. In the West Indies it is most used, and is prescribed in bilious remittent fevers, diarrhœas, and dysenteries, and might be given in many cases in which tonics are indicated.

Dose.—Of the powder, gr. v to gr. xv.
Of the infusion, ʒiss, ter die.

Prep.—Inf. Cuspariæ.

CYDONIUM.

The seeds of the CYDONIA VULGARIS. *Quince Tree.*

This tree is probably a native of Crete, but grows wild in some parts of Austria. It is cultivated in most European countries. The fruit is large, resembling a pear, of a delightful fragrant odour, making a pleasant confection. The seeds only are used officinally. The coriaceous envelope of the seeds abounds in mucilage, which boiling water extracts. Two drachms will make a pint of water thick and ropy. This is the sole principle for which they are valuable.

Medical Properties.—The mucilage of these seeds is useful in coughs as a demulcent, and has been sometimes applied to the eyes in inflammation of the conjunctiva.

Dose.—Ad libitum.

Prep.—Decoctum Cydonii.

CYMINUM.

The fruit or seeds of CUMINUM CYMINUM.

The plant affording these seeds grows about six or eight inches high, is a native of Egypt, but cultivated for its seeds in Sicily, Malta, and other parts of South Europe.

They have a strong unpleasant odour, particularly when rubbed; this depends upon an essential oil of a yellowish colour, and lighter than water.

Medical Properties.—Similar to those of the seeds of other aromatic umbelliferous plants, but rather more stimulating. They have been introduced into plasters.

Prep.—Empl. Cymini.

DAUCI FRUCTUS ET RADIX.

The fruit and root of DAUCUS CAROTA. *Common Carrot.*

This plant may be called indigenous, and is also found in most other European countries. It grows wild very freely. By cultivation, the root is considerably altered in its appearance and flavour. It is not indicated in the Pharmacopœia whether the cultivated plant should be used or not; but as the wild plant possesses stronger properties, that one is probably intended. The carrot plant has a biennial fusiform root, and an annual herbaceous stem. The fruit and root are officinal.

The fruit, commonly called seeds, are of a light brownish colour, presenting on their convex surface four ridges, to which stiff whitish hairs or bristles are attached. They have an aromatic odour, and a warm pungent, bitterish taste. By distillation they yield a little volatile oil, on which their virtues chiefly depend. The active properties are taken up by boiling water.

Medical Properties.—Moderately excitant and diuretic, and are employed in chronic nephritic affections and dropsy; well adapted where the stomach is in an enfeebled state. The dose is from ʒss to ʒj of the bruised seeds; or a pint of infusion, containing half an ounce of the seeds, may be taken in the day.

Carrot Root, in the wild state, is whitish, hard, coriaceous, branched, of a strong smell, and an acrid disagreeable taste. The cultivated root is too well known to need description, tastes pleasantly sweet, and mucilaginous. The constituents of the root, according to the analysis of Braconnot, are—

Crystallizable and uncrystallizable sugar; a little starch; extractive; gluten; albumen; volatile oil; vegetable jelly (pectin); malic acid; saline matter; lignin; a crystallizable colouring principle named carotin.

Medical Properties.—The wild root possesses much the same properties as the seeds, and may be used for the same purposes. The cultivated root has obtained some reputation as an external application to phagedenic sloughing ulcers, the fetor of which it corrects, and changes the morbid action. It is used in the form of scrapings, if it is wished to stimulate mildly. The boiled root, beaten into a pulp, is the more common form, and becomes a very nice emollient cataplasm.

DIGITALIS.

The leaves of Digitalis Purpurea. *Common Foxglove.* This is a very common plant in our country, found likewise in most other parts of Europe. It flowers in the summer, and the commencement of flowering is the best period for gathering the leaves. These are considered most active in the plants which grow wild, and those that have attained their full growth. They are to be stripped from the stem; and the petioles and midrib should be removed, and the green part only carefully dried by a gentle heat. To preserve them light and moisture should be excluded by enclosing them in tin cases. The seeds are officinal in some Pharmacopœias, but are seldom used.

Properties.—In the fresh state, foxglove leaves have no odour, but have a faint narcotic smell when dried. Their taste is bitter and nauseous. The colour of the powder is a fine deep green. The virtues are yielded to water and alcohol.

According to the analysis of Radig, digitalis contains in 100 parts of the leaves—

Picrin (Digitaline of Le Royer)	0·4
Digitaline (active principle)	8·2
Scaptin (acrid extractive)	14·7
Chlorophylle	6·
Oxide of iron	3·7
Potash	3·2
Acetic acid	11·
Vegetable albumen	9·3
Woody fibre	43·5

Medical Properties.—Digitalis is sedative, diuretic, and narcotic. When taken in quantities sufficient to powerfully affect the system, it occasions pain in the head, vertigo, dimness of sight, and confusion of thought. It sometimes excites nausea and even vomiting; and, in addition to these, an increased flow of urine. This occurs both in a person in health as well as in one suffering from disease, although it is more perceptible in the latter; as in cases of dropsy, in which the secretion of urine is generally very much diminished. It may be remarked, that digitalis does not act as a diuretic till it has lowered the pulse, especially in dropsies; and does not appear to be a diuretic through any specific quality existing in the plant. In most cases of excessive vascular action, the natural secretions are diminished; and digitalis, by lowering the circulation to a more healthy standard, may restore the vessels to their usual functions.

The most remarkable property of digitalis is its influence upon the heart, the irritability and tone of which it appears evidently to diminish. This takes place from comparatively small repeated doses, varying in time from two to several days. Much depends upon the condition of the drug, the habit of the patient, and the state in which he keeps himself: for it is a curious fact that, if a person be walking about much, digitalis scarcely affects him in even rather large doses. When digitalis has been taken a few days, the patient begins to feel rather weak and faint, which feelings are increased by rising from the recumbent posture. The pulse is found to be much reduced in frequency, in some cases as low as 50, or even 30 beats in a minute; and by getting up suddenly, this pulse rises to 100 or even 150, the heart labouring very much, and the patient feeling faint. It is not very rare that the enfeebled heart is in this way overpowered, and fatal syncope ensues. In consequence of this impression on the pulse, digitalis may be useful in some inflammatory diseases, after blood has been drawn repeatedly, and as long as the system appears able to bear it; the morbid action of the heart may then be somewhat controlled by digitalis. The diseases in which it is most used are, pleuritis, phthisis, mania, epilepsy, and pertussis. By repressing the excited movement of the heart, it is useful in aneurisms, hypertrophy of the heart, and the gouty and rheumatic irritation of the same organ. It may in fact be used in inflammatory diseases generally, as an adjuvant to bloodletting, but cannot be solely relied upon.

Whilst taking it, the patient should be carefully watched, and visited at least once a day, as it is one of those remedies which has an accumulative action; that is, it may appear for some days to have no effect, and suddenly the patient becomes very low; the heart is rendered feeble, as if the united action of all the doses was operating. Therefore, as a general rule, if in moderate doses it produces no effect in four days, the remedy should be discontinued, and a brisk purgative be administered; the day following the digitalis may again be given in rather larger doses.

Should the patient be attacked by the symptoms of its accumulated operation, such as, a feeble pulse, nausea, stupor, cold sweats, prostration of strength, and tendency to fainting, he must be strictly kept in the recumbent posture to prevent the heart being called into too much action, cordials and diffusible stimulants may be given with discretion, and even brandy, in extreme cases. The latter should generally be omitted, as it is a too permanent stimulus, and as digitalis is given to relieve inflammatory or abnormal vascular action; whilst we are benefiting one state, we might be aggravating the other.

Dose.—Of the powder, gr. ss to gr. iij, ter die.
tincture, ♏ x to ♏ xx.
infusion, ʒij to ʒiv.
extract, gr. ss to gr. ij.

Prep.—Inf. Digitalis.
Tr. Digitalis.
Extr. Digitalis.

DULCAMARA.

The young stalk of SOLANUM DULCAMARA. *Bitter-sweet, Woody Nightshade.*

This shrub is indigenous, and is very extensively diffused over Europe and North America. The root and stalk chiefly possesses medical properties; the latter only is officinal. The berries, commonly reputed to be very poisonous, have very slight noxious qualities. The twigs are gathered in autumn, after the fall of the leaf, and cut into pieces, from one to two inches long. They are, when dried, inodorous; with a taste at first bitter, afterwards sweet. Boiling water extracts all their virtues. These are supposed to depend upon an alkaline substance, named Solania, in combination with malic acid. Solania is procured by adding magnesia to a decoction of the stalks to precipitate the solania, which is taken up by hot alcohol in the usual manner. The bitter-sweet principle has been named *Picroglycion.*

Medical Properties.—Alterative, diuretic, and narcotic: for the latter purpose it is never used. It is chiefly given in lepra, psoriasis, and pityriasis; and was warmly recommended by Dr. Bateman. It is said to do good also in chronic rheumatism. In overdoses it occasions nausea, vomiting, fainting, vertigo, and irregular muscular action.

Dose.—In powder, gr. x to gr. xx.
Of the decoction, ℥ij to ℥iv, ter die.

Prep.—Decoct. Dulcamaræ.

ELATERIUM.

The fresh Pods of Ecbalium Officinarum, *alias* Momordica Elaterium. *Squirting Cucumber.*

This plant is a native of the South of Europe, and is now cultivated for medical use in this country. Its stem is herbaceous and the root perennial; its leaves are rough, cordate, and angular. The fruit is oval, about an inch and a half in length, and one inch in breadth, containing much juice and many seeds; when ripe it is separated from its stalk, and at that moment the juice and seeds are emitted with considerable force. The most active part of the fruit is the juice surrounding the seeds, the seeds and body of the fruit being comparatively inert. If this thin juice be allowed to stand some time, it deposits a light gray substance, which may be separated by pouring off the supernatant liquid, then drying it either in the sun or by a gentle heat. This fecula is named Elaterium. In preparing it, little or no pressure should be employed, to prevent mucilage, or other inert matter falling with it. The quantity of good Elaterium procurable is about an eighth of a grain from each pod.

Elaterium is found in thin flat pieces, often presenting on one surface marks of the linen upon which it has been dried, of a greenish-grey colour, with a bitter acid taste.

If dark-coloured, it is generally weaker. Its activity as a medicine depends on the presence of a peculiar principle, named Elaterine, which has been separated successfully by Mr. Hennell, of London. This, with chlorophylle, forms the Elatin previously described by Dr. Paris. According to the analysis of Mr. Hennell, Elaterium contains in 100 parts—

Crystallizable substance (Elaterin) . . .	44
Green resin	17
Starch	6
Woody fibre	27
Saline matters	6

Mr. Morris, of Edinburgh, describes Elaterin as forming in small rhomboidal prisms, presenting in mass a silky appearance. It is bitter and styptic to the taste, insoluble in water and alkaline solutions; soluble in alcohol, ether, oils, and sparingly in acids. He obtained it by evaporating an alcoholic solution of Elaterium to an oily consistence, then throwing it into water, when a white precipitate immediately falls. This is Elaterin, which may be purified by dissolving in alcohol, and again introducing it into water. Its strength is ten times greater than that of ordinary Elaterium.

Medical Properties. — This substance is a powerful hydragogue and drastic cathartic, and in some degree diuretic. In large doses it often occasions nausea and vomiting, also hypercatharsis and inflammation of the bowels. It is most commonly administered in ascites, hydrothorax, and anasarca, and may be combined with other purgatives when brisk purging is indicated. It acts by irritating the mucous membrane of the intestinal canal, causing the exhalants to throw out much serous fluid, and the mucous follicles to secrete more abundantly: copious stools result, the aggregate amounting, not unfrequently, to a gallon. In consequence of this profuse discharge, a want of fluid is felt in the circulation, and therefore the absorbents are set to work to absorb it from the cavities, to replace it in the blood. Another mode of explaining its operation might be the following. The Elaterium irritates the large mucous surface of the intestinal canal, and causes a considerable flow of blood to it, thus diverting it from the serous membrane for a time, and suspending secretion there. The absorbents acting briskly, take up some fluid and carry it into the circulation, by which the quantity may be greatly diminished. The most satisfactory explanation of its operation is this: by the copious discharge of its thin watery particles, the blood becomes inspissated, and this circumstance favours the passage of the thinner fluid of the cavities, by exosmose, through the coats of the membranes and vessels into the blood, on the principle very ably explained and advocated by Dutrochet. In ovarian dropsy, Elaterium is almost useless, because the fluid is encysted, and the cysts are imperfectly supplied with absorbing vessels; therefore, removal of it in that way cannot be accomplished.

Dose.—A quarter of a grain to a grain or more, after repeatedly taking it. It may be given in pill, and repeated every second or third hour, till it operates. The dose of Elaterin is $\frac{1}{16}$th to $\frac{1}{8}$th of a grain.

ELEMI.

The resin of an uncertain tree.

The tree which has been described under the name of Amyris Elemifera grows in Brazil, and, according to some, in Carolina; the Elemi is obtained by making incisions into the tree, from which the juice flows, and concretes upon the bark. It is of a pale yellow colour, sometimes with a shade of green, in some specimens reddish-brown. It bears a close resemblance to Abietis Resina. It contains, according to Bonastre—

Resin	60 per cent.
Resin soluble in boiling alcohol, not in cold . .	24 „
Volatile oil	12·5 „
Extractive	2 „
Acids and impurities	1·5 „

Medical Properties.—Elemi is not used internally. Externally applied, it acts as a rubefacient and stimulant, and is introduced into ointments and plasters.

Prep.—Ung. Elemi.

ERGOTA.

The diseased grain of Secale Cereale. *Common Rye.*

The precise nature of the substance which we call Ergot of Rye is not agreed upon by naturalists. Some contend that it is a fungous growth, as Fries, who names it *Acinula Clavus;* Decandolle calls it *Klerotium Clavus;* some consider it to be a diseased ovarium; and others consider it to be a morbid growth, produced through a puncture, analogous to the formation of the gall-nut. It is generally considered in this country to be a parasitical growth upon the grain to which the names *ergotætia abortans* or abortifaciens have been applied, The drug is imported into this country from France and Germany, and some is said to find its way here from the United States.

Properties.—Ergot is in solid, brittle, yet somewhat flexible grains, from half an inch to an inch in length, curved like a spur, whence its French name; of a violet-brown colour externally, yellowish-white within, with an unpleasant smell in mass, resembling putrid fish, of a taste at first scarcely perceptible, afterwards disagreeable and slightly acrid. Wiggers, a German chemist, who carefully analysed it, discovered in 100 parts—

A peculiar fixed oil	35·0
White crystallizable soft matter	1·04
Cerin	0·75
Substance resembling fungin of mushrooms	46·18
A reddish-brown substance, which he named *ergotin*	1·24
A substance resembling osmazone	7·76
A peculiar saccharine matter	1·54
Gummy extractive	2·32
Albumen	1·46

Besides saline and earthy matters in a very minute proportion.

Medical Properties.—In small doses Ergot of Rye produces no sensible effect on the male, but in the female has a strong tendency to affect the uterus, the contractility of which it is able to augment to a surprising degree. In large doses it is liable to cause nausea and vomiting, and in larger doses headache and fever. The nauseating effects are not requisite for its action on the uterus. When eaten in food, as in rye bread in some countries, it has had a most pernicious influence, producing dry gangrene, typhoid fever, and disorder of the nervous system, attended with convulsions.

The most important use of this substance is in aiding parturition. The cases suited for its administration are, protracted labours depending on atony of the uterus, and from the same cause retention of the placenta and hæmorrhage. In protracted labour, the conditions necessary to admit of its use, are a dilated state of the os uteri, a natural presentation, well-formed pelvis, a disposition of the external parts to yield, no presumed malformation of the child, and rupture of the membranes.

The objections to its use are, the danger of rupturing the uterus, death of the child from too great compression, and laceration of the perinæum. It usually acts within a quarter of an hour, and the contractions of the uterus, when excited, are constant, not intermitting as in healthy labour, and they will be felt after the expulsion of the fœtus. Its use is sometimes attended with considerable after-pains, which, however, can be checked by a full dose of opium.

Not more than four doses should be given, as there is no probability of its acting afterwards, and its long-continued use might be attended with mischief. It has also been given with good results in menorrhagia and hæmorrhages generally, and to check other discharges from mucous membranes, as in diarrhœa, gleet, and gonorrhœa. Its action in this way is not fully understood. It would appear to contract the capillaries of those surfaces, and thus diminish the quantity of fluid which escapes; on a similar principle might be explained its mode of causing gangrene, in which it contracts the capillaries, and diminishes the quantity of blood so much as to be insufficient to afford adequate nutrition and vitality.

Dose.—In powder ℈j to ʒss.

The best mode of giving it is to have it coarsely powdered, then to put it into a teacup, and pour upon it two or three ounces of boiling water, let it stand till it is cool enough to drink, then add a teaspoonful of brandy or gin to flavour it, and let the patient drink the infusion and dregs as well. This may be repeated two or three times. The tincture and other liquid preparations do not appear to be so certain in their operation.

Prep.—Tinct. Ergotæ Ætherea.

Dose.—ʒss.

FARINA.

Wheat flour, obtained from TRITICUM VULGARE ET HYBERNUM. *Common Wheat.*

Wheat flour is inodorous and nearly insipid. Its chief constituents are starch, gluten, saccharine matter, and gum. The proportions of which are liable to variation. Vauquelin obtained as an average product from eight specimens, in 100 parts—

Water	10·25
Gluten	10·80
Starch	68·08
Sugar	5·61
Gum	4·11

The gluten, which is the most nutritious vegetable substance and in greater quantity in wheat than any other grain, is composed of two principles, named by Taddei, gliadine and zymome, and by Einhoff, a German chemist, gluten and vegetable albumen. The former only is soluble in alcohol. Both of them contain nitrogen.

Medical Properties.—Wheat flour in its simple state is seldom used in medicine. It is sometimes sprinkled over the skin in erysipelatous inflammation and some cutaneous eruptions, or in cases of burns, in which cases it seems to have a very soothing effect. In the state of bread and toasted and put into water, a refreshing drink is made, which is still more palatable if flavoured by lemon juice. Boiled in water or with milk, it forms a common bland poultice. The crum of bread is used as a vehicle or to give bulk to some active medicines in the form of pill, as nitrate of silver. The combination is not very judicious, as bread usually contains some chloride of sodium, which decomposes nitrate of silver and makes it inert.

Prep.—Cataplasma Fermenti.

FERRI PERCYANIDUM.

The Percyanide of Iron, commonly known as Prussian Blue.

Prussian blue is said to be generally made in the following manner: animal matter, such as dried blood, hoofs, or horns, is mixed with an equal weight of carbonate of potash and introduced into an iron vessel. This is exposed to a red heat for half an hour to an hour, and when cold is to be treated with water. The solution is filtered and then mixed with a solution of alum and protosulphate of iron; in which case a precipitate falls, at first of a dingy green colour, which by repeated washing with dilute muriatic acid, acquires a fine blue tinge. It may also be formed immediately by adding a solution of ferrocyanide of potassium to any persalt of iron. According to Berzelius it is a compound of—

4 sesquicyanuret of iron,
3 cyanuret of iron:
or of—7 iron $7 \times 28 = 196$
9 cyanogen $9 \times 26 = 234$
430

Mr. Phillips has named the substance a percyanide of iron, a name which will not be found in chemical works generally.

FERRUM.

Iron Wire.

Iron is a metal which is more generally diffused over the earth than any other. It occurs native in small quantity, combined with sulphur very abundantly, and is found largely oxidized and united with acids, such as carbonic, sulphuric, phosphoric, arsenic, and chromic. It is extracted from its ores chiefly by the agency of heat, charcoal, and fluxes.

Iron combines with oxygen in four proportions; forming the protoxide, the black oxide, peroxide, and ferric acid. The first has one equivalent of oxygen, the peroxide one and a half. The black oxide is intermediate, and by chemists generally supposed to consist of one equivalent of protoxide, and two of peroxide. The salts of the protoxide are most energetic as medicines, the free peroxide being comparatively inert.

The preparations of Iron considered generally, are powerfully tonic, raising the pulse, promoting healthy secretions, and appearing to increase the colouring matter of the blood, for when given in cases of anæmia and chlorosis, where the blood has a less arterial colour, it is changed to a very bright arterial tinge and gives a healthy complexion to the whole body. The preparations of iron are useful in diseases attended with debility and relaxation of fibre, and a languid circulation, especially when resulting from excessive coloured discharges. The diseases in which they are most serviceable, are chlorosis, hysteria, leucorrhœa, gleet, scrofula, rickets, chorea, and passive hæmorrhages, and some neuralgic affections. They are contraindicated in the inflammatory diathesis, and in such cases would occasion heat, thirst, headache, difficulty of breathing, and other symptoms of an excited circulation.

Iron wire is now ordered instead of the *filings.*

Medical Properties.—In the metallic form, iron has no action on the body, but in its passage it may become oxidized, as appears to be the case from the black appearance of the evacuations. Iron filings have been considered by some to be tonic and anthelmintic, but are seldom prescribed, as there is little certainty in their operation. They may be given in doses of xx to xxx grains.

FICUS.

Figs, the dried fruit of Ficus Carica. *Fig Tree.*

The fig tree is supposed to be a native of the Levant, and is now found in abundance in all the warmer parts of Europe. Our chief supply is from Smyrna. The fig itself is a fleshy receptacle, containing within it the flowers, and afterwards the seed. When perfectly ripe, figs are dried by the heat of the sun or in ovens. In cold weather they are covered with a whitish saccharine efflorescence, which melts in the summer and makes them moist. Their chief constituents are sugar and mucilage.

Medical Properties.—Laxative, nutritious, and demulcent. When eaten largely, they produce flatulence, griping, and diarrhœa, and in some persons will occasion hæmorrhoids. They sometimes are introduced into demulcent decoctions; and, when roasted or boiled, have been employed as a poultice to hasten suppuration.

Dose.—Almost ad libitum.

Prep.—Conf. Sennæ,—Dec. Hord. Comp.

FŒNICULUM.

The fruit of Fœniculum Dulce. *Common Fennel.*

This is an herbaceous annual plant, a native of the South of Europe, and now growing freely in our own country. The fruit only is officinal.

Fennel seeds or fruit have a fragrant odour, and a warm, sweet, agreeable aromatic taste. They impart their virtues partially to water, more freely to alcohol. The essential oil may be separated by distillation. There is also fixed oil; from 960 parts of seeds, Neuman procured 20 parts of volatile oil, 120 of the fixed.

Medical Properties.—Stimulant and carminative, and as a corrective of the griping qualities of senna and some other purgatives. Fennel water is very useful to allay the griping to which infants are liable.

Dose.—For an adult, ℈j to ʒss.

Prep.—Aqua Fœniculi,—Conf. Pip. Nigri,—Sp. Juniperi Comp.

GALBANUM.

The Gum-resin of Galbanum Officinale.

This species of Galbanum is of the nature of an undershrub, growing several feet in height. It is found along the eastern coast of Africa, and is said to be a native of Syria. Galbanum is obtained by making incisions into the stem, or cutting it off at a little distance from the root. A cream-coloured juice exudes, which concretes on exposure to the air. A small quantity exudes spontaneously from the joints, and hardens in the shape of tears. The drug is brought from the Levant.

The odour of galbanum is peculiar and disagreeable. Its taste is bitterish, warm, and acrid. Rubbed with water, it forms rather a milky liquid, from which most of the galbanum is deposited by standing. Alcohol dissolves a large portion of it and forms a tincture, which is rendered turbid by the addition of water. It is most soluble in proof spirit. Pelletier found in 100 parts:

Resin	66·86
Gum	19·28
Volatile oil and loss	6·34
Wood and impurities	7·52

By distillation at about 250 degrees, the essential oil passes over and has a blue colour, which it imparts to alcohol. By distillation with water this oil has a yellow tinge.

Medical Properties. —Stimulating, expectorant, antispamodic, and emmenagogue. The diseases in which it is most given, are hysteria and dyspepsia, in old people, attended with borborygmi, and in chronic asthma. It is used externally as a discutient plaster, but it more frequently accelerates the suppurative process.

Dose.—Gr. v to gr. x.

Prep.—Pil. Galb. C.,—Empl. Galb. Comp.

GALLA.

The *Gall-nut*, a morbid deposit, forming the nidus of the Cynips Quercus Folii.

The species of oak on which gall-nuts are found is the Quercus Infectoria, which grows abundantly in various parts of Asia. The galls are shipped largely from Aleppo and Smyrna. The mode in which they are produced is the following: The insect, a species of fly, makes a perforation in the small twigs and petioles, and deposits an egg; this acting like a foreign body, causes a quantity of matter to be thrown out around it, and constitutes the nut, which becomes a nidus for the insect. These nuts are formed very rapidly, sometimes in as little time as twenty-four hours. After a short period, the egg is converted into a larva, which feeds upon the vegetable matter surrounding it. It next becomes a chrysalis, and at length it assumes the form of a fly and eats its way out, leaving a perforation and cavity. The gall-nuts should be collected before the insect has made this perforation, and in that state are named blue, green, or black galls, in contradistinction to others which are perforated and have a lighter colour, and are named white galls. There are some collected in France and other countries, but not at all equal in quality.

Properties.—The best galls are externally of a bluish or lead colour, light brown internally, solid, and brittle, with a small cavity in their centre. They are inodorous, and have a bitter astringent taste. From 800 parts, Sir H. Davy procured 185 parts soluble in water, consisting of—

130	tannin.
31	gallic acid.
12	mucilage and matter rendered insoluble by maceration.
12	saline matter and calcareous earth.

Pelouse found in 100 parts—

Tannic acid	40·0
Gallic acid	3·5
Ellagic acid and insoluble matter	50·0
Extractive colouring matter	6·5

Other chemists describe the presence of more tannin and gallic acid, and another acid which they name ellagic, also some volatile oil.

Medical Properties.—Gall-nuts are powerfully astringent, both internally and externally. They are very seldom used for internal diseases; chronic diarrhœa might be treated with them. They are more employed as an astringent gargle or wash, or an injection. The most common application of them is in the form of an ointment, made with one drachm of gall-nuts in powder to an ounce of ointment, in the treatment of hæmorrhoids. They are used abundantly in the making of ink and other purposes in the arts.

Dose.—If given internally, gr. x to gr. xx.

Prep.—Tinct. Gallæ,—Ung. Gallæ Comp.

GENTIANA.

Gentian, the root of GENTIANA LUTEA.

This variety of Gentian has an annual stem which sometimes grows to a height of three or four feet, and a perennial root. It is common about the Alps, Pyrenees, and Apennines. Its root only is officinal, and is imported principally from Havre and Marseilles.

Gentian root has a grayish-brown colour externally, yellowish within, and of a spongy texture. It has a feeble odour, and a taste slightly sweet, but very bitter. The powder is of a yellow colour. Messrs. Henry and Caventou discovered in it—

A principle named Gentianin; a volatile odorous principle; a substance like bird-lime; a greenish fixed oil; a free organic acid; uncrystallizable sugar; gum; yellow colouring matter; lignin.

In Switzerland and the Tyrol, gentian root is macerated in water, and undergoes fermentation. From this a spirituous liquid is distilled, which is much relished by the inhabitants.

Gentianin, as above mentioned, is now said to consist of two principles, *gentisin* and *gentianite*. Gentisin is yellow, forms acicular crystals, has feeble acid properties, and unites with alkalies. Gentianite is obtained in the form of an extract, combining in itself fat, wax, and odorous resin. It is the bitter principle of gentian root.

Medical Properties.—Gentian is one of the best vegetable tonics. It creates appetite and improves the digestive powers, without occasioning any very decided symptoms of stimulation. It is useful in all diseases requiring such remedies, and is compatible with many substances that cannot be given properly with other vegetable bitters. Alone it may be used with the salts of iron, but not in the form of the Pharmacopœial preparations. It may be given in powder, infusion, extract, or tincture. The extract is an excellent vehicle for pills containing some mineral tonic.

Dose.—Of the powder, gr. x to gr. xx.
Extract, gr. v to gr. x.
Infusi Gent. c., ℥iss.
Tinct. Gent. c., ʒj to ʒiij.

Prep.—Inf. Gent. Comp.,—Extractum Gentianæ,—Tinct. Gent. Comp.

GLYCYRRHIZA.

The fresh root of Glycyrrhiza Glabra. *Liquorice Plant.*

This plant has a perennial root, and an annual herbaceous stem which grows to a height of three or four feet. The root only is officinal. It is a native of the South of Europe or Syria, and is now cultivated and grows freely in our own country.

By analysis, Robiquet found in this root—

A sweet yellow transparent principle, named Glycyrrhizine; a substance resembling Asparagin; starch; albumen; a brown acrid resin; a brown azotized extractive matter; lignin; some salts of lime and magnesia.

An extract of Liquorice root is imported from Spain and Italy; it is made by boiling the root in water for some time to extract the soluble matter, and the solution after straining is evaporated to a proper consistence. It generally contains some impurities, such as little pieces of leaves or charcoal, sometimes starch, prunes, and even sand.

A very pure and pleasant extract is made at Pontefract in Yorkshire, which is sold very extensively under the name of Pontefract cakes or lozenges.

Medical Properties.—Liquorice root is a very good demulcent, useful in catarrh, or irritation and inflammation of the urinary passages or alimentary canal. It is often used with other medicines to conceal their taste and make them more palatable, as the black draught, which, with the aid of liquorice, can be swallowed much more easily by the fastidious. Before being used, the root should always be deprived of its epidermis, as it is somewhat acrid, and does not possess the properties of the root generally. By long boiling, the acrid principle is renewed. The powder is much used in pills, when we require a powder to give a certain consistence. It is also put loose into pill-boxes to prevent pills sticking together.

Dose.—Ad libitum.

Prep.—Extractum·Glycyrrhizæ.

GRANATUM.

The rind of the fruit and bark of the root of PUNICA GRANATUM. *Pomegranate.*

The pomegranate is a small shrubby tree growing abundantly in the south of Europe, Africa, the East and West Indies. The fruit, for which it is chiefly cultivated, varies much in size and flavour. The pulp is red, pleasantly acid, and sweetish, and is used for the same purposes as orange juice. The rind of the fruit, and bark of the root, are mentioned in our Pharmacopœia; but in others the flowers and even seeds are ordered.

The rind of the fruit is hard, dry, and brittle, of a yellowish-brown colour, without smell, of an astringent, slightly bitter taste. It contains a large proportion of tannin, and in countries where it abounds is used for tanning skins.

The flowers and young fruit, named sometimes *balaustines,* are inodorous, have a bitter, strongly astringent taste, and give a violet colour to the saliva. They contain tannin and gallic acid, and were used by the ancients in dyeing.

Bark of the Root.—The root is hard, heavy, ligneous, covered with a yellowish-gray bark, yellow within. It has no smell, but an astringent taste without bitterness. It contains, according to Mitouart, tannin, gallic acid, a substance like wax, a sweet substance, part of which is soluble in alcohol, another part in water, resembling mannite. The woody part of the root is inert.

Medical Properties.—The rind of pomegranate is powerfully astringent, and in some degree tonic. It is not much used with us. It might be employed as a gargle in relaxation of the uvula, or be given in diarrhœa, dysentery, intermittents, or be used as an injection in leucorrhœa. The bark of the root has much reputation as an anthelmintic, especially for the removal of Tænia. For this purpose, it is constantly given by the Mohammedan physicians, and medical practitioners of India. They give it generally in the form of a decoction, which may be made by boiling two ounces of the bark in a quart of water down to a pint; of this one third may be given for a dose, and repeated every second hour till the worm is expelled. Two or three doses are usually sufficient. It is usual to precede its administration by a purgative given over night, which appears to assist the action of the remedy. The modus operandi of this substance in destroying worms is not very obvious. Although next to inert on the human body, it may act as a poison upon the worm, as we observe in Quassia upon Insects. By itself it does not purge, nor produce any symptoms beyond a little nausea and vertigo.

The berries, or pulp, are in some countries taken in fevers, as a refrigerant.

Dose of the Rind.—Gr. x to gr. xx.

Prep.—Decoctum Granati,—Decoct. Granati Radicis.

GUAIACI LIGNUM ET RESINA.

The wood and resin of GUAIACUM OFFICINALE.

The Guaiacum tree grows in Jamaica and Hayti, and some parts of the neighbouring continent. It is slow in its growth, and attains an elevation of fifty or sixty feet, with a circumference of from three to five feet. All parts of the tree possess medical properties; but the wood and concrete juice only are officinal. The wood is imported in large billets, covered with a grayish bark. It is much used by turners for various instruments and utensils, on account of its hardness, and is commonly known by the name of *lignum vitæ*. The raspings and shavings are kept in the shops for medical purposes.

The alburnum, or sap-wood, is yellow; that of the duramen, or hard wood, greenish-brown. It is almost without smell, unless rubbed or heated, when it becomes odorous. In burning, it gives out an aromatic odour. Its taste is somewhat bitter, and pungent after long chewing: it yields its virtues in a very slight degree to water.

The resin is procured as a spontaneous exudation, or by incisions made into the trunk, but chiefly by boring the billets at one end and placing the other end on a fire, by which the resin flows out, and is received in calabashes. A fourth plan is to boil the chips in water, and skim off the substances which rise to the surface. It varies considerably in its appearance in respect to colour, and the impurities contained in it; however, it is essentially of a resinous lustre and fracture. The colour is dark, with brownish edges, which become green on exposure to light and air. The powder also acquires a very green colour. This is said to be owing to the absorption of oxygen. Guaiacum is not a gum-resin, as it is sometimes denominated, nor a resin, but a substance sui generis; only 9 parts per cent. are soluble in water: alcohol takes up 95 parts in 100, leaving only impurities. The alcoholic solution is of a deep-brown colour, is decomposed by water, which precipitates the guaiacum, and affords blue, green, and brown precipitates, with the strong acids. It is also soluble in ether, alkaline solutions, and sulphuric acid. Nitric acid converts it into oxalic acid. It gives a blue colour to gluten, mucilage of acacia, and milk, and it is in this way that it becomes a test of colchicum, which contains gluten, when it is in its most efficient state. The portion which is soluble in water is a species of extractive; the other is not purely a resin, as it differs from resin in several particulars. It contains more carbon; is converted into oxalic acid, instead of artificial tannin, by nitric acid; and by its action passes through various shades of colour, as green, blue, and brown, in this respect resembling indigo. The changes of colour are supposed to depend upon the absorption of various proportions of oxygen.

Medical Properties.—The wood and resin possess similar properties, only differing in degree, that is, they are more concentrated in the resin. Guaiacum is considered to be stimulant, alterative, diaphoretic, diuretic, and in large doses purgative. It was at one time supposed to be a valuable antisyphilitic, but at present considered only to be of service in the secondary and chronic forms of it. It is used in skin diseases, chronic gout and rheumatism, amenorrhœa, and scrofulous affections. The only disease in which it can be given with much hope of benefit is chronic rheumatism. The decoction made with the wood is a comparatively useless preparation, as so little of it is soluble in water: it is also almost useless in the compound decoction of sarsaparilla. The best way to give it is to use the resin suspended in liquids by mucilage, or in the form of the tinctures.

Dose.—Gr. x to gr. xx.
Of the Tinct., ʒj to ʒij.
Of the Mist., ℥j to ℥ij.

Prep.—Decoct. Sarzæ comp.,—Mistura Guaiaci,—Pil. Hyd. Chloridi comp.,—Tinct. Guaiaci,—Tinct. Guaiaci comp.

HÆMATOXYLUM.

The wood of HÆMATOXYLON CAMPECHIANUM. *Logwood Tree.*

This tree is a native of Campeachy and the shores of the bay of Honduras. The wood, which is the officinal portion, is much used in dyeing. It comes over in logs, having a blackish-brown colour externally. For medical use it is cut into chips, or rasped into a coarse powder. The wood is of a deep-red colour, becoming darker by exposure to air, of a very slight, peculiar odour, and a sweet astringent taste. It imparts its colour to water and alcohol. Amongst its constituents, Chevreul discovered—

A volatile oil; an oleaginous resinous matter; a brown substance precipitated by gelatine; a brown substance soluble in water and ether, but not in alcohol; a substance resembling gluten; free acetic acid; some saline matters; an azotized colouring principle, named hematine.

By boiling in water a solution is procured, which yields an extract by evaporation.

Medical Properties.—Logwood is a mild astringent, acting without irritating or stimulating. Its taste being rather pleasant, it is taken willingly in the diarrhœa attendant upon phthisis, or in any chronic diarrhœa or dysenteric affection. It should be known that it gives a dark blackish colour to the evacuations.

Dose.—Of the Decoction, ℥j to ℥ij.
Extract, gr. xx to gr. xxx.

Prep.—Decoct. Hæmat.,—Extr. Hæmatoxyli.

HELLEBORUS.

The root of HELLEBORUS NIGER.

This plant is a native of Greece, having an annual stem and perennial roots. It grows freely in most parts of South Europe, and is cultivated and thrives in our gardens. It is known also by the name of Christmas Rose; by the Greeks it was called Melampodium.

Properties.—The root is found most commonly in the form of brownish-black fibres, which have grown downwards from a horizontal knotted root-stock. They are internally white, or yellowish-white, almost without odour, with a bitter, nauseous, acrid taste. They are much more acrid in the fresh than the dry state. MM. Feneulle and Capron obtained from them—

A volatile oil; an acrid fixed oil; a resinous substance; wax; a volatile acid; bitter extractive; gum; albumen; gallate of potash; supergallate of lime; a salt of ammonia; woody fibre.

Water and alcohol extract the active principles.

Medical Properties.—Drastic cathartic, emmenagogue, and anthelmintic. It is probable that the two latter qualities depend upon the purging. At present it is seldom used, but was much employed formerly in amenorrhœa, mania, melancholia, dropsy, epilepsy, some skin diseases, and worm cases. It is still used much in Turkey, on account of its effect upon the liver, which it stimulates to a considerable increase of secretion. This, when evacuated largely, gives a blackish appearance to the evacuations, and was probably the reason, that in those diseases in which it was found serviceable, the pathology of them was supposed to be locked up black bile; hence the term melancholia. I have heard from persons who have used hellebore rather extensively, that it is an excellent adjunct to scammony and aloes, and that its operation on the liver may often be substituted for that of calomel. At present it is rarely prescribed, except as an emmenagogue.

Dose.—Gr. x to gr. xx; as a brisk purgative, emmenagogue, and anthelmintic.
Gr. ij to gr. v; as an alterative.
Of the Tincture, ♏ xx to ʒj, ter die.

Prep.—Tinct. Hellebori.

HIRUDO.

Sanguisuga officinalis, or medicinalis. *Leech.*
Cl. 1, Annelides. Ord. 3, Abranchiatæ. Fam. 2, Asetigeræ: Cuvier.

The Leech is an aquatic worm, with a flattened body, tapering towards each end, terminated in circular flattened discs, the hinder one being largest; the mouth is placed in the centre of the anterior disc, and is supplied with three cartilaginous lens-shaped jaws. These jaws are lined at their edges with fine sharp teeth, and meet so as to make a triangular incision in the flesh. Respiration is carried on by apertures, ranged along the sides of the under surface. The medicinal leech is characterised by six longitudinal ferruginous stripes, the four lateral ones being interrupted or tesselated with black spots. The colour of the back varies from a blackish to a grayish-green; the belly in one variety is yellowish-green, with lateral dark stripes; in another, green, bordered, and spotted with black: either may be employed. They are found in the marshes and rivers of many places in Europe. After the incision is made in the skin, they extract the blood by suction, that is, forming a vacuum, in the same manner as the child extracts milk from the breast.

Medical Uses.—Leeches are employed when we want to extract blood locally, and when it may be inconvenient to remove it in any other way. The quantity of blood taken by a leech may, on an average, be considered two drachms, and together with the subsequent bleeding half an ounce. It is generally considered that blood thus extracted causes greater depression for the quantity than when removed by usual venesection, but this is strenuously denied by some; great care should be taken in the case of applying leeches to very young children, as death by the after-bleeding has been occasioned by a single leech. The methods employed to stop the bleeding are, to press the edges of the orifice together for several minutes between the fingers; to use pressure by lint, piece after piece, and kept *in situ* by adhesive plaster; sprinkling on the part powdered resin, or plaster of Paris; applying Tinctura Ferri Muriatis; or by introducing into the orifice the end of a stick of nitrate of silver. In still greater difficulty, a needle with silk may be introduced through the edges, and used as a ligature. Erysipelas is apt to follow the application of leeches, especially about the forehead and eyelids, and this takes place in some irritable constitutions of the body, even in any other part.

HORDEUM.

The seeds of HORDEUM DISTICHON, deprived of their integuments. *Barley.*

This herbaceous plant is known in most civilised countries. The grain of it only is officinal. It is of a yellowish colour externally, white within, having a faint odour in a mass, and a mild sweetish taste.

The seeds, according to Proust, contain in 100 parts—

Meal	70·05
Husk	18·75
Water	11·20

Barley meal, according to the same author, contains in 100 parts—

Starch	67·18
Fibrous matter (gluten, starch, and lignin)	7·29
Gum	4·62
Sugar	5·21
Gluten	3·52
Albumen	1·15
Phosphate of lime with albumen	0·24
Moisture	9·37
Loss	1·42
	100

Malt consists of the seed, in which the germination has commenced, and been arrested. During this change, the starch partially disappears and is resolved into dextrine and sugar. It is very largely consumed in the manufacture of malt liquor.

Hulled barley is merely the grain deprived of its husk, which, according to Einhoff, amounts to 18·75 per cent.

Barley meal is made by grinding the seeds after being deprived of their husk. It has a grayish-white colour, and may be made into a coarse, heavy, hard bread, which is used in some countries as food.

Pearl barley, hordeum perlatum, is the seed deprived of ts investments, and rounded and polished in a mill. It is in round or oval grains, having the trace of the longitudinal furrow, and of a pearly whiteness. It abounds in starch, with some gluten, sugar, and gum. This is the proper officinal barley.

Medical Properties.—Barley is very mild, and one of the least irritating of farinaceous substances. Boiled in water, it forms a decoction, much employed in fevers and inflammatory diseases as a drink, which conveys nourishment in the mildest form, and at the same time lubricates and soothes the primæ viæ.

Malt affords a liquid of a similar nature, but is rather more nutritious and stimulating; it is better suited in cases requiring a supporting treatment.

Dose.—Ad libitum.

Prep.—Decoctum Hordei.
Dec. Hord. compos.

HYDRARGYRUM.

Mercury exists, in a very small quantity, in a metallic state, also combined with chlorine, and in the form of an amalgam, but by far the most abundant condition is in combination with sulphur. Its most important mines are at Almaden in Spain, Idria in Austria, and the duchy of Deux Ponts; it exists more sparingly in Mexico, New Granada, Peru, the Philippine Islands, and China. It is now said to be very abundant in California.

Extraction.—It is obtained from the native sulphuret, also named Cinnabar of commerce, by mixing it with lime, then applying heat, which causes the mercury to pass over into receivers kept cool and containing water. In this process a fourth part of the sulphur of the mercury decomposes three equivalents of lime, attracting the oxygen to form sulphuric acid, which combines with the undecomposed fourth of lime to form sulphate of lime. Three parts of sulphur, with three of calcium, form three equivalents of sulphuret of calcium, the metallic mercury being set free.

Mercury is usually imported from Spain in iron bottles, weighing from 70 to 100lbs. It comes from Trieste in skins containing each about 30lbs., and these are put into barrels. Mercury is used to assist in extracting silver and gold from their ores, in preparing vermilion, also for making thermometers and barometers, for silvering looking-glasses, in gilding, and for preparing many powerful and very important pharmaceutical compounds.

Mercury is sometimes adulterated with tin, bismuth, and lead, which still allow it to remain liquid, and without much altering its appearance. The signs of its impurity are a dull surface, staining a clean plate or paper, not forming in small quantity round portions, but appearing to drag a tail behind it. It may be purified by distilling it from those metals which are not volatile; washing it with dilute nitric or hydrochloric acid, which act more readily on the impurities than on the mercury. It may also be pressed through chamois leather to cleanse it. Mercury combines in two proportions with oxygen, sulphur, chlorine, and iodine, and in one with cyanogen.

Medical Properties and Modus Operandi.—Mercury in its pure state has scarcely any action on the body, although it was formerly considered to be very efficacious in removing obstructions in the intestines, as in ileus, colic, and hernia, and that it did this mainly by its gravity. Such a use of it is now abandoned. It was also imagined to be capable of clearing the complexion, and was taken in large doses with that intention. When this was the practice, a very lucrative perquisite of servants was being allowed to collect the mercury which escaped from the body at dances or other parties. In combination mercury acts on the system as a peculiar and general stimulant. The general effect of mercurials should be first considered, and the peculiarities of individual preparations under each. Mercury is usually said to be stimulant, alterative, purgative, sialogogue, and diuretic.

When mercurials are first taken into the stomach, especially calomel, the first impression appears to be that of a sedative, which is more evident the larger the dose; this action continues only for a short period, that is from ten minutes to half an hour. The proof of it is, diminished action of the heart, diminished irritability of the stomach and bowels. This condition is followed by reaction, occasioned either by an impression made on the nerves of the stomach, and conveyed by sympathy to other parts, or by the mercury entering the circulation. The latter explanation is strenuously opposed by some, who contend that mercury never enters the fluids; and supported by others who have found it in the blood, likewise deposited in the tissues, and have observed that it transudes from the skin. This is proved by administering mercurials by the stomach; when the system is saturated with it, gold or silver carried on or near the surface have often been seen tarnished by the mercury forming an amalgam with them. The saliva often does the same, and mercury in a metallic state has been deposited in the bones, when none of it in that form has been swallowed, or even rubbed on the surface.

As a stimulant mercury is supposed to be beneficial in a great many diseases. In syphilis, it has been usual to say that the medicine sets up a new disease or action in the system, and that the one induced being more powerful puts a stop to the primary disease, and gives time for the parts to recover their healthy condition. Still no one has ventured to show or prove where the new disease is seated: some refer it to the capillaries, which are supposed to be in a state of erethism, others to the salivary glands, some to the absorbents, others to the large glands of the body. The alterative action of mercury is sometimes exerted, without being attended with any other vital phenomenon than the removal of the disease, whilst at others its effects indicate the agency of a potent stimulant. In the latter case its operation is marked by a quickened circulation, with a frequent jerking pulse; by an increased activity of the secreting functions, especially of the salivary glands and the liver; by exaltation of nervous sensibility; and indeed general excitement of the organic actions of the system. A patient in this state somewhat resembles one labouring under fever. If blood be drawn from the arm, it has a buffed and cupped inflammatory appearance.

As a purgative, mercury acts principally by increasing the action of the liver. The bile becomes the stimulant to the intestines, and it is also probable that the mucous follicles likewise secrete more abundantly. After copious purging by a large dose of calomel, the secretion of the liver and intestines appears to be less for a few days.

When mercury is taken in moderate quantities for several days, its operation is generally felt most on the salivary glands, causing an immoderate flow of saliva. Under these circumstances, to the alterative effects are added those of depletion and revulsion. Sometimes its depleting action is exhibited in an increased secretion of urine, thus constituting it a diuretic.

In functional derangement of the digestive organs, *mercurials* in small doses operate very beneficially, and often without inducing any sensible effect. In these cases no disturbance of the vital functions takes place, but the alvine discharges, if previously clay-coloured, assume a healthy colour, showing that the secretion of the liver is increased. The decided action of mercury on the hepatic system is more agreed upon than that upon any other, for whether the liver be torpid and obstructed, as in jaundice, or pouring out a redundancy of morbid bile, as in melæna, it is equally useful in unloading that viscus, and restoring its secretion to a healthy state.

In acute and chronic hepatitis in India, it is considered almost a specific, but its use is generally preceded by blood-letting. In inflammations of mucous and serous membrane, mercurials are very valuable; they induce a new action of the exhalants, causing them to throw out a thinner and less objectionable fluid, and when effusion has taken place, they excite the absorbents to remove what has been already deposited. In this manner its action is explained in peritonitis, meningitis, hydrocephalus, bronchitis, pleuritis, pneumonia, croup, iritis, dysentery, rheumatism, hydrothorax, ascites, and anasarca. In syphilitic disease mercury is very extensively used. Its action here is not clearly understood, but is said to be that it operates by substituting its peculiar action for that of the disease.

For inducing the specific effects of mercury, blue pill or calomel is generally employed; when the bowels are irritable, and the medicine passes off by them, it is necessary to introduce the mercury by inunction, and when a speedy effect is desired, the external and internal use may be simultaneously resorted to.

The first observable effects of mercury in inducing ptyalism are a coppery taste in the mouth, a slight soreness of the gums, and an unpleasant sensation in the sockets of the teeth, when the jaws are pressed together;

shortly afterwards the gums begin to swell, a line of whitish matter is seen along their edges, and the breath has a fetid smell, called mercurial fetor. The saliva at the same time flows abundantly, and the gums, tongue, throat, and face become much swollen, ulceration attacks the lining membrane of the mouth and fauces; the jaws are very painful; the tongue is coated with a white thick fur, and saliva flows in streams from the mouth. This state sometimes progresses to a dangerous extent, causing ulceration, sloughing, and gangrene, which require great skill in combating. The fetor of the breath has been supposed to depend upon an exhalation of fetid matter, such as sulphuretted hydrogen, &c., which has been carried from the intestines into the circulation, by the powerfully excited absorbents. The best remedies for excessive salivation are cool air, astringent and detergent gargles, as of acetate of lead in solution, sulphate of copper and zinc, dilute sulphuric acid, leeches applied to the throat, sulphur and saline purgatives, and gargles of chloride of soda or lime diluted with water.

The above are the ordinary effects of mercury, but in some constitutions it produces consequences more terrible than the disease itself. It occasions a small frequent pulse, anxiety about the præcordia, pale and contracted countenance, great nervous agitation, and alarming general debility. It sometimes causes a peculiar eruption on the skin, which is known by various names, as hydrargyria, eczema mercuriale, and lepra mercurialis.

The preparations of mercury in the London Pharmacopœia are the following: Empl. Amm. c. Hyd.,—Empl. Hydrarg.,—Hyd. c. Cretâ,—Hyd. Oxyd.,—Hyd. Binoxydum,—Hyd. Nitrico-oxydum,—Hyd. Ammonio-Chlor.,—Hyd. Chloridum,—Hyd. Bichloridum,—Liq. Hyd. Bichlor.,—Hyd. Bisulph.,—Pilula Hydrarg.,—Pil. Hyd. Chl. comp.,—Pil. Hyd. Iodidi,—Ung. Hyd. Fort.,—Ung. Hydrarg. Mitius,—Ung. Hyd. Nitratis,—Ung. Hyd. Nitrico-oxydi,—Ung. Hyd. Iodidi,—Ung. Hyd. Biniod.,—Ung. Hyd. Amm. Chloridi.

The following preparations of mercury are omitted in the last Pharmacopœia—

HYDRARGYRI BICYANIDUM.

Ingredients:

Percyanide of Iron (Prussian blue),
Binoxide of Mercury,
Distilled Water.

Decomposition.—The percyanide and binoxide decompose each other; the cyanogen unites with the mercury to form a soluble bicyanide of mercury; the oxygen with the iron forms a sesquioxide which is precipitated. By evaporation the bicyanide is procured in crystals. It may also be obtained by adding the binoxide of mercury to hydrocyanic acid, when we have formed two equilavents of water and one of bicyanide of mercury.

Composition:

2 cyanogen 2 × 26 = 52
1 mercury 2 = 202
254

Formula Hg 2 Cy.

Qualities.—It is translucent, and totally soluble in water. When hydrochloric acid is added to it, bichloride of mercury and hydrocyanic acid are formed; the latter of which is known by its odour, and throws down a precipitate from nitrate of silver, soluble in hot nitric acid. By heat cyanogen is evolved, leaving globules of mercury.

This is not given medicinally, and is only intended to be employed in procuring hydrocyanic acid speedily.

HYDRARGYRI BINIODIDUM.

Ingredients:

Mercury,
Iodine,
Alcohol.

This is a case of direct combination of iodine with mercury, forming the biniodide, of a most brilliant red colour.

Composition:

2 iodine 2 × 126 = 252
1 mercury = 202
454

Formula $Hg I^2$.

Qualities.—By heat carefully applied, it passes into scales, which turn yellow, and on cooling again becomes red. It is partially soluble in hot rectified spirit, and on cooling, the biniodide forms in crystals. It is soluble either in excess of iodide of potassium or bichloride of mercury, and is entirely soluble in chloride of sodium, which will distinguish it from the iodide of mercury.

Medical Properties.—The same as of the iodide, but more powerful in its action.

Dose.—Gr. ½ to gr. ij.

HYDRARGYRI SULPHURETUM CUM SULPHURE.

Ingredients:

Mercury,
Sulphur.

When these are rubbed together, the mercury combines with part of the sulphur, the rest being mechanically mixed with it.

It is presumed to contain in 100 parts—

Bisulphuret of mercury	52
Sulphur	48

Qualities.—By heat it entirely passes into vapour, without leaving charcoal or phosphate of lime, showing that animal charcoal has not been mixed with it for adulteration.

Medical Properties.—A very mild alterative, only given to children.

Dose.—Gr. v to gr. xx.

HYOSCYAMUS.

The leaves of HYOSCYAMUS NIGER. *Henbane.*

This plant is indigenous, growing in the fields and road sides. It is well known by the fetid odour which is given out when the plant is handled and pressed. It is biennial, and the leaves of the first year's growth are generally of a deeper green than those of the second, which have a browner hue. The latter are considered to be most active. The leaves only are now officinal.

The active principle of this plant is alkaline, and has been named Hyoscyamia. The analysis, however, has been very imperfectly made. This alkaloid considerably resembles atropia in its properties.

Medical Properties.—Henbane acts on the nervous and vascular system, reducing their action, that is, diminishing the sensibility, and lowering the pulse. It has a mild aperient operation, on which account it is often a valuable substitute for opium, and besides, it tranquillises without stimulating. This drug is useful in coughs and most pulmonary diseases, and indeed in almost every affection in which it is desirable to mitigate pain without producing excitement. Like belladonna it dilates the pupil of the eye, though in a weaker degree, and may be applied in a similar manner. Some recommend henbane externally in the form of poultice or fomentation, and vehemently extol the benefits derived from it. Henbane is usually administered in the form of tincture or extract.

Dose.—Of the extract, gr. iij to gr. x; of the tincture, ʒss to ʒj.

Prep.—Extr. Hyosc.,—Tinct. Hyoscyam.

JALAPA.

The tuber of Exogonium Purga.

This plant is a native of Mexico, and derives its common name from Xalappa, a city in the state of Vera Cruz. The stem is herbaceous, but the tuber or root is perennial, and sometimes attains a considerable size.

Properties.—The tuber when small is imported entire, but when large is usually sliced longitudinally, sometimes in transverse circular pieces. It is pear-shaped, and shows marks of incisions which have been made to facilitate the drying. Internally it exhibits strata of a darker substance, which is chiefly the resin. Jalap on analysis affords, according to Mons. Guibourt, in 100 parts—

Resin	17·65
Sugar soluble in alcohol	19·
Brown saccharine watery extract	9·05
Gum	10·12
Starch	18·78
Woody fibre	21·60
Loss	3·80
	100

The active part of Jalap has been named Jalapin, but this, according to late researches, cannot be separately exhibited. The best menstruum for dissolving the active matter of jalap is proof spirit.

Jalap is very apt to be attacked by worms, which, however, only remove the amylaceous and gummy matter, leaving a larger portion of active substance. Hence worm-eaten jalap is the best, and should be used when it is desirable to procure the drug in its most active form.

Adulterations.—It is said to be sometimes adulterated with bryony root; this is seldom, if ever, practised; occasionally pieces of another variety of Ipomæa named Mechoacan have been mixed with it; but they are readily distinguished by a much lighter colour.

Medical Properties.—Jalap is an active cathartic, operating on every part of the intestinal canal, causing severe griping, liquid evacuations, and increased secretion of urine. It acts both on the muscular and mucous coats. It enters into the purgative powders which are usually given to children, combined with calomel, scammony, and some aromatics. It is often administered in dropsies with bitartrate of potash, in the dose of ten to fifteen grains of the former, and two drachms of the latter.

Its activity is much increased by the addition of two or three grains of pulvis Ipecacuanhæ.

Dose.—Of the powder, gr. xv to gr. xxx.
Of the extract, gr. vj to gr. xij.

Prep.—Extr. Jalapæ, — Pulv. Jalapæ comp.,— Pulv. Scammonii comp.,—Tinct. Jalapæ.

INULA.

The root of Inula Helenium. *Elecampane.*

This plant is indigenous, and also found in many parts of Europe. Its root is perennial, but the stem annual. The root should be dug up in autumn, and in the second year of its growth; it is generally cut into longitudinal slices, and carefully dried. The root has a camphorous odour, and when chewed a warm, aromatic, somewhat bitter taste; water or alcohol extracts its virtues. On analysis it affords—

Inulin; helenin, a concrete substance, partaking of the properties of camphor and volatile oils; bitter extractive; soft, acrid, bitter resin; gum; albumen; lignin; volatile oil (a trace); wax; several salts, chiefly of potash and lime.

The principle, named *Inulin*, closely resembles starch, but differs in forming a yellowish-brown precipitate with iodine, and in being partly thrown down unchanged from its solution in boiling water.

Medical Uses.—This drug is seldom or never prescribed alone at the present period. It is said to be tonic, stimulant, deobstruent, emmenagogue, and diaphoretic. It was formerly given in dyspepsia, depending on debility, and in chronic diseases of the liver; as also in amenorrhœa. It enters into the preparation named Ward's Paste.

Dose.—Gr. v to gr. xv of the powder.

Prep.—Conf. Piperis.

IODINIUM.

Iodine was discovered in 1812 by Mons. Courtois, a soda manufacturer at Paris. Its properties were immediately investigated by Gay Lussac and Sir Humphrey Davy; and its station assigned to it in chemistry.

Natural State and Preparations.—Iodine exists in many vegetables, especially the Laminariæ and Fuci; also in sponge, the oyster, various polypi, and other sea animals; in sea-water, in minute quantity; and in some springs. It exists in combination with some base, more frequently sodium or potassium. It is usually procured from kelp, by several processes. The one most commonly described is the following: Dissolve kelp in water, evaporate, that crystallization may take place, remove the carbonate of soda, and use the residual liquid, which is named Mother-liquors, or Soapmaker's-lees, which contains the Iodine, with sodium and potassium. To this add sulphuric acid and peroxide of manganese; apply heat, and let the disengaged Iodine pass over into a receiver, where it will condense in a solid form. The decomposition, in this process, may be explained in the following manner: An equivalent of oxygen of the manganese passes to the sodium or potassium, to form soda or potash, with which the sulphuric acid immediately unites; the rest of the acid combines with the protoxide of manganese, and the Iodine set free is driven over by heat.

Qualities.—Iodine is a solid, of a dark steel-grey colour, in thin scales. It is easily volatilized, producing a plum or violet coloured vapour; it has an odour, somewhat like chlorine; stains the fingers, though not permanently; water dissolves it imperfectly, taking up only a seven-thousandth part. An ounce of alcohol will dissolve from about forty to forty-five grains. Its solution in water is promoted by adding iodide of potassium. Iodine unites with several metals, forming very energetic compounds; they are named iodides, or iodurets.

The presence of Iodine in liquids is easily detected by starch, which will discover it in 450,000 times its weight of water. The conditions are, that the Iodine be free and the solution cold.

Iodine has been adulterated with black lead, peroxide of manganese, and charcoal, which are, however, easily discovered by the application of heat, which will vaporise Iodine, and the impurities will remain.

Medical Properties.—Iodine was first used in goitre by Dr. Coindet, of Geneva. It acts on the body as a general stimulant, but exerts its action, especially on the glandular system. The glands affected by it particularly are, the thyroid, the absorbent glands, the mamma, testicle, as also the liver, pancreas, and kidneys. In some few instances it becomes a sialogogue. In over-doses it causes inflammation of the stomach, and becomes an irritant poison. Iodine enters the circulation, and has been detected in many of the tissues and fluids of the body. It has been used very successfully in a great number of diseases: most so in those in which effusions have taken place, and in which there appears to be torpor of the absorbents. The diseases benefited by it are, chronic hydrocephalus, enlarged tonsils, ulcerations in the throat, bronchocele, cancer of the breast, early stages of phthisis, chronic hepatitis, enlargement of the spleen, diseased mesenteric glands, ovarian dropsy, enlarged testicle, and most diseases connected with a scrofulous diathesis. There is no remedy which has equal power over scrofulous enlargement or ulceration of the absorbent glands. It has also often proved an excellent emmenagogue. It is sometimes a valuable remedy in hysteria, chorea, paralysis, and deafness, and in many cutaneous diseases.

It should be always borne in mind that Iodine should not be exhibited in a plethoric or inflammatory condition of body; but is most serviceable where there is diminished action and reduced nervous energy. Iodine requires care in its administration, for if given in excess it causes a train of unpleasant symptoms, such as heat and dryness in the throat, with a sense of constriction, pain and heat at the stomach, vomiting, colic, severe pain about the head, hot and dry skin, and a rapid strong pulse, symptoms indicating an inflammatory condition. In such cases the Iodine should be discontinued, and purgatives, with other antiphlogistic remedies, should be had recourse to. Occasionally bloodletting is requisite.

In addition to internal administration, Iodine is used externally, either to produce a topical action or an impression on the system generally. It may be applied as an ointment made with gr. x of Iodine, with ʒss to ʒj of Iodide of Potassium to an ounce of lard. This has a mahogany colour, and may be rubbed on a part night and morning. The Iodide, or Biniodide of Mercury, may be used in a similar manner in the quantity of ʒss of the Iodide to an ounce of lard.

Iodine, with Iodide of Potassium, has been used by Lugol as a lotion in ophthalmia, ozæna, and scrofulous ulcers.

A rubefacient solution may be made by dissolving half an ounce of Iodine with an ounce of Iodide of Potassium in six ounces of distilled water. The same substance, with less water, forms the Iodine caustic, which has been successfully employed in stimulating and destroying soft and fungous granulations.

Iodine has also been made available in the form of baths, and, in diseases affecting the surface, has benefited, when the internal use of the medicine was precluded, on account of the irritability of the mucous membrane of the alimentary canal.

The preparations of Iodine are numerous. The following are those most in use:

Tincture of Iodine, made by dissolving forty grains of Iodine in an ounce of rectified spirit.

Dose.—♏ x to ♏ xx.

If this tincture be added to water, it will not remain in a state of solution, unless a little Iodide of Potassium be added, which will not only keep it dissolved, but add to its virtues. They form together an Ioduretted Iodide of Potassium.

Iodide of Potassium.

Dose.—Gr. ij to gr. x.

Iodide of Mercury.

Dose.—Gr. j to gr. iij.

Biniodide of Mercury.

Dose.—Gr. ss to gr. ij.

Iodide of Lead.

Dose.—Gr. ¼ to gr. j.

Used with the same intention as most of the preparations of Iodine.

Iodide of Iron.

Dose.—Gr. j to gr. vj.

Syrup of Iodide of Iron.

Dose.—ʒss to ʒjss.

Prep.—Ferri Iodidum,—Hydrarg. Iodidum et Biniodidum,—Plumbi Iodidum,—Pot. Iodidum,—Liq. Pot. Iodidi comp.,—Pil. Hyd. Iodidi,—Tinct. Iodinii comp.,—Ung. Hyd. Iodidi et Biniodidi,—Ung. Iodin. comp.

IPECACUANHA.

The root of CEPHAELIS IPECACUANHA.

This plant grows plentifully in thick, moist, and shady woods in Brazil. The root is imported in pieces of two or three lines in thickness, variously bent and contorted, consisting of an internal, slender, whitish, ligneous cord, with a thick cortical covering, which presents on its surface unequal circular rings, separated by narrow fissures, which frequently extend nearly down to the central fibre. This has given rise to the name of Annulated Ipecacuanha, to distinguish it from some spurious varieties. The cortical part is hard and horny, breaks with a vitreous fracture, and is easily separated from the woody part, which contains the virtues of this drug in a weaker degree. Much importance has been attached to the colour of this root, and has given rise to a division into three kinds; the brown, the red, and the grey. They all contain the same principles, and almost in the same proportion, differing only in age, place of growth, and mode of drying. But when in either variety the bark is opaque, with a dull amylaceous appearance, the root is less active as a medicine. Ipecacuanha, when entire, is almost inodorous; but, pulverised, has an unpleasant nauseous smell, which occasions, in some persons, violent sneezing; in others dyspnœa, resembling asthma. The taste is bitter, acrid, and nauseous. The cortical part consists, according to the analysis of M. Pelletier, in 100 parts, of—

Impure salt of Emetia	16
Odorous fatty matter	2
Wax	6
Gum	10
Starch	42
Lignin	20
Loss	4

M. A. Richard has detected a small quantity of acid, which he considers to be gallic. The ligneous portion, amounting to about one fifth, contains less than 2 per cent. of Emetine.

Emetine may be obtained by the following process: Digest powdered root of Ipecacuanha in ether for some time, then in alcohol, strain the solution and add to it magnesia, which precipitates the Emetine. Wash the precipitate with cold water subsequently, treat it with boiling alcohol, which will dissolve the Emetine and yield it by evaporation or distillation.

Emetine is alkaline, does not crystallize, has a yellowish colour and a bitter taste, is almost insoluble in water and ether, freely soluble in alcohol. It is precipitated from its solution by gallic acid. Its action is very powerful, one grain being more than equal to a scruple of powdered Ipecacuanha.

Formula of Emetine $C^{35} H^{25} O^{9}N$.

Medical Properties.—Ipecacuanha acts as an expectorant, diaphoretic, nauseant, and emetic; it also assists the operation of purgatives; in very small doses some consider it to be tonic. As an emetic its operation is mild, and unattended with much danger, and is advantageously administered at the commencement of the exanthemata and other fevers; in ague, and in diseases generally, where a relaxing effect is desirable. It is not a suitable emetic in cases of poisoning. It is much used in dysentery. As a nauseant, it is of value in pertussis, asthma, and hæmorrhages; as an expectorant, in most pulmonary diseases; and is a most excellent remedy in most inflammatory diseases of children, especially if it requires to be continued for several days. In children, we prefer it to Tartar Emetic, because the latter, after some days, is liable to cause ulceration in the bowels, whereas no such effect results from Ipecacuanha, if continued for a long time. Moreover, if by accident an over-dose be administered, it need not give much alarm, for it will cause vomiting, and thus become a cure for its own effects.

Modus Operandi.—As an expectorant and diaphoretic, Ipecacuanha acts by producing relaxation of the exhalants, causing them to allow a more free passage of thin watery fluid. These effects freely attend the presence of nausea. As an emetic in intermittents, it is also valuable by relaxing the exhalant and capillary vessels, obviating that contraction which attends or chiefly causes the cold stage of agues, and thereby preventing the congestion of the deep-seated large vessels. In inflammatory diseases generally it does good, by diminishing the heart's action, determining to the surfaces, relieving the deep-seated organs from congestion, and thus equalising the circulation.

In cases of poisoning it is objectionable, on account of its slow operation, seldom acting before a quarter of an hour; before the vomiting, nausea occurs, which is supposed by many to be a state which facilitates the absorption of poisons; and when vomiting has ensued, it is attended with considerable prostration, a condition not to be desired in cases of poisoning.

Dose.—As an expectorant and diaphoretic, gr. ss to gr. ij.
As a nauseant, or to aid purgatives, gr. ij to gr. iv.
As an emetic, ℈j to ʒss.

For children, a teaspoonful of the Vinum Ipecacuanhæ, every quarter of an hour, until it operates.

Prep.—Pulv. Ipecac. comp.,—Vin. Ipecacuanhæ.

JUNIPERI CACUMINA ET FRUCTUS.

The tops and fruit of JUNIPERUS COMMUNIS. *Common Juniper.*

This is an evergreen shrub, usually small, but sometimes attaining an elevation of eight or ten feet. The fruit named *galbalus* is a globular berry, formed of the fleshy coalescing scales of the ament, and containing three angular seeds. The tops also are officinal. It is common in most parts of Europe. All parts of the plant contain a volatile oil, which gives them a peculiar flavour.

The best berries come both from the north and south of Europe, especially Hamburgh, Trieste, and the Italian ports.

They have an agreeable aromatic odour, and a sweetish, warm, bitterish, slightly terebinthinate taste. They owe their virtues to a volatile oil which may be separated by distillation. The other ingredients, according to Tromsdroff, are—

Resin; sugar; gum; wax; lignin; water; some saline substances.

The berries impart their virtues to water and alcohol, and are largely consumed in flavouring hollands and gin.

Medical Properties.—Stimulant and diuretic; they give to the urine a smell of violets; they are seldom used alone, most generally in combination with other diuretics. They are given in dropsies, scorbutic affections, skin diseases, catarrh of the bladder, and atonic states of the alimentary canal and uterus. Their good effects are not very decided. They may be used in the solid form bruised with sugar, in the dose of a drachm two or three times in a day, or in infusion, or spirit.

Prep.—Decoct. Scop. c.,—Sp. Juniperi comp.,—Ol. Juniperi.

KINO.

The extract of PTEROCARPUS MARSUPIUM.

Kino is not the product of the tree above mentioned alone. There are several varieties in the markets which are known to be produced by different trees.

1st. *East Indian* or *Amboyna Kino* is the most common; it is said to be obtained from the Nauclea Gambia, a native of Malacca and the island of Sumatra.

2d. *West Indian* or *Jamaica Kino* is said to be obtained from the Coccoloba Uvifera; of this at present very little is now supplied.

3d. *African Kino;* the original variety is the product of a tree growing in Senegal and the neighbouring countries; its name is Pterocarpus Erinaceus. The drug very rarely finds its way to us from Africa.

4th. *Botany-Bay Kino;* this is the concrete juice of the Eucalyptus resinifera. When the bark is pierced, the juice flows freely and is dried in the sun. Mr. White states that one tree affords five hundred pounds' weight in one year.

However, with all the labours and disputes about the nature of the tree and modes of procuring kino, it is quite evident that there is no certain or satisfactory knowledge on the subject, nor is the want of precise information a great detriment to the medical man.

General Properties.—Kino is in small irregular shining pieces of a very deep reddish-brown colour, brittle, and pulverizable; the powder is of a lighter colour. It has no smell, but an astringent, bitterish, subsequently sweetish taste. It is partially soluble in cold water, more so when hot, and deposits, on cooling, a reddish sediment. Alcohol dissolves a greater proportion. It consists chiefly of a modification of tannin with extractive matter, and in some specimens, a little resin. It has no gallic acid. The alkalies favour its solubility in water, but at the same time weaken its astringency.

Medical Properties.—Kino is one of the best of the vegetable astringents, applicable in most cases in which such remedies are indicated, as diarrhœa, chronic dysentery, passive hæmorrhages, leucorrhœa, diabetes, &c.

It is also useful as an injection in leucorrhœa and gonorrhœa, as a topical remedy in epistaxis, introduced up the nose, and is said to be serviceable when applied to indolent and flabby ulcers. It may be given in powder in doses of gr. x to gr. xxx, or an infusion may be made of it, with two drachms of kino to half a pint of water, and of this one ounce may be given three or four times a day. There is also a tincture, of which two drachms may be a dose.

Prep.—Tinct. Kino,—Pulv. Kino comp.

KOUSSO or KOSSO.

The drug known as Kousso consists of the dried flowers of a tree named *Brayera anthelmintica*. It is a native of Abyssinia, and is much esteemed in that country for its anthelmintic virtues. Its botanical character has not been clearly described, but it is placed in the natural order Rosaceæ. The flowers have been analysed by Wittstein and Martin. According to Wittstein they contain *fatty oil*, *chlorophylle*, *wax*, butter and resin, tasteless resin, sugar, gum, *tannin* striking a green colour with iron, *tannin* striking a blue colour with iron, *vegetable fibre* and *ashes* which contained *potash*, *lime*, *magnesia*, *oxide of iron*, *sulphuric* and *phosphoric acids*, *chlorine* and *silica*. From the analysis of Martin they contain *starch*, *saccharine matter*, *vegetable extractive matter*, *green*, *very odorous matter*, and a crystallized substance named *koussine*.

Medical Properties.—The only medical quality assigned to this substance is that of an anthelmintic in the treatment of tape-worm chiefly, but it may be tried for other intestinal worms. The chief objection to its use is its bulkiness and mode of administration. The plan recommended is this: for an adult, an ounce of powdered kousso, which should be treated with 8 or 10 ounces of hot water and allowed to stand for a quarter of an hour, at the expiration of which the contents should be shaken or stirred up, and the whole should be swallowed in two or three draughts, and washed down with some cold water. It is better to precede the medicine by some mild laxative, and if it does not pass off by the bowels in three or four hours, a mild dose of castor oil should be given. The dose for a child may be from ʒi to ʒij.

KRAMERIA.

The root of KRAMERIA TRIANDRIA. *Rhatany.*

This is a shrub with a branched spreading root of a blackish-red colour, a native of Peru, very abundant about the city of Huanuco.

Rhatany root is without odour, but has a bitter, very astringent, slightly sweet taste, much stronger in the cortical than in the ligneous parts. The smallest pieces on this account are preferable. The virtues of the root are extracted by boiling water, which forms a dark brown infusion. With alcohol, a deep reddish-brown tincture is obtained, from which a precipitate falls on the addition of water. From 100 parts Vogel obtained—

Red astringent matter, a modification of tannin . .	40
Lignin	48
Minute quantities of gum, starch, and gallic acid.	

Most mineral salts and acids throw down precipitates with its solution, and are therefore incompatible.

Medical Properties.—It is somewhat tonic and a powerful astringent. It may be given in just the same cases as kino or catechu, and in about the same doses. It is considered to be an excellent ingredient in tooth powder, and its solution is used as an astringent wash for the gums.

Dose.—Gr. x to gr. xxx. An equivalent quantity may be given in the form of infusion or tincture. An extract is made from it, of which ten to fifteen grains may be given.

Prep.—Inf. Krameriæ.

LACMUS.

Litmus. The prepared ROCCELLA TINCTORIA.

This is a variety of Lichen, very abundant in the Canary and Cape de Verde Islands. In preparing litmus the plant is collected and coarsely powdered, then macerated and fermented in close wooden vessels for several weeks with urine and either potash or soda. The colouring matter is thus evolved, and the prepared mass is removed, dried, and cut into little squares for use.

It has an alkaline urinous smell, tinges the saliva of a deep blue, and is saline and somewhat pungent to the taste. It is soluble in water, and is thus used to stain paper for chemical purposes. It is employed as a test of acids, which immediately convert the blue colour into red;

and after being reddened, the blue colour is restored by the contact of alkalies.

It is not used medicinally.

LACTUCARIUM.

The inspissated juice of LACTUCA SATIVA. *Garden Lettuce.*

This plant is annual, and is now found in most warm and temperate climates. At the time of flowering it contains a quantity of milky juice, which exudes when a portion of its stem is cut off, and which, collected and dried, forms a brown light mass, named Lactucarium. It is collected by cutting off the stem and flowering tops, that the juice may exude: then taking this up by sponges or cotton, and squeezing out the liquid, and subsequently drying it by a gentle heat. Many other processes are spoken of, but less common and important. In its concrete state, Lactucarium somewhat resembles opium, both in appearance and odour; it is partially soluble in water; the undissolved portion appearing to contain wax, resin, and caoutchouc. It contains a free acid, a narcotic principle, but not morphia, as some have asserted.

From the lettuce an extract is made, by bruising and pressing the leaves before the periods of flowering; the expressed juice is then evaporated to a proper consistence, and is known as the extractum lactucæ. It is milder than Lactucarium, and very variable in its action.

Medical Properties.—Anodyne, sedative, and hypnotic. It produces these effects without stimulation, and even appears to lower somewhat the heart's action. Hence it may be substituted for opium in many cases. The disease in which it has been most used is consumption, and it may generally be employed to allay cough and nervous irritation. Very few place any confidence in it, and its use is very limited.

Dose.—Gr. ij to gr. v.

LAVANDULÆ OLEUM.

The oil of LAVANDULA VERA. *Common Lavender.*

This is a small shrub, found in almost every garden in this country, and abundant in most other parts of Europe. The flowers only are officinal.

They possess a highly fragrant odour, not only when fresh but dried, and this they preserve for a long time; their taste is warm, pungent, and aromatic. Alcohol takes up their virtues, which depend upon a volatile oil, which may be procured separate by distillation.

Medical Properties.—Aromatic, stimulant, and tonic, useful in states of nervous debility. It is more used, however, on account of the agreeable odour, in perfumery, or as an elegant adjunct to other medicines.

Prep.—Tr. Lavand. c.,—Ol. Lavandulæ,—Lin. Camph. c.

LAURI BACCÆ.

The berries of Laurus Nobilis. The *Bay Tree.*

This species of laurel is evergreen, and is now found in most mild climates. It is presumed to be a native of the South of Europe, where it sometimes attains an elevation of twenty feet. The fruit is an oval berry, of the size of a small cherry, and when ripe, of a dark purple, nearly black colour. The leaves and fruit, and an oil expressed from them, are the officinal portions.

The leaves have a fragrant odour, and a bitter aromatic taste. They yield by distillation a volatile oil, on which their virtues mainly depend. They impart their flavour to water, and are often employed to improve the taste of custards and puddings.

The berries when dried are black and wrinkled, and contain two oval fatty seeds within a friable envelope: or they may be considered as drupes, with a kernel divisible into two lobes. They have a taste and odour like the leaves, but are more pungent. Besides a volatile oil, they contain a concrete, fixed, green oil, which may be procured by expression or docoction.

Medical Properties.—The leaves and berries are aromatic and narcotic, but are now very rarely prescribed.

They are chiefly employed to give a pleasant odour to external remedies.

Prep.—Conf. Rutæ,—Empl. Cumini.

LIMONES.

The fruit of Citrus Limonum.

LIMONUM CORTEX.

The outer rind of the fruit.

LIMONUM OLEUM.

The oil distilled from the outer rind of the fruit.

LIMONUM SUCCUS.

The juice of lemons.

The lemon tree bears a considerable resemblance to the orange tree; but is distiuguished by the leaves, flowers, and fruit. The leaves are larger, slightly indented at their edges, have footstalks, destitute of winged appendages. The flowers have a purplish tinge on their outside, and the fruit is of a paler colour, and more oval, and pointed at its extremities. This tree is a native of Asia, now cultivated in most warm civilised countries. The fruit is imported from the Mediterranean and West Indies.

The rind of the fruit has a fragrant odour, and a warm aromatic bitter taste, depending on a volatile oil, which can be separated by distillation or expression. The peel imparts its virtues to water or alcohol.

The juice is sharply acid, and of a pleasant flavour, consisting of water, citric acid, mucilage, and extractive.

Medical Properties.—The rind or peel is somewhat tonic, but most used on account of its pleasant flavour to render other substances more palatable. The juice is refrigerant, and is freely used in fevers, as a refreshing and agreeable beverage. It is also given in the form of a neutral salt, or saline draught, and is very eligible when we wish the bowels not to be much relaxed. It is generally associated with potash, soda, or ammonia. The relative strength of lemon juice to citric acid is about half an ounce to eighteen grains; so that in prescriptions the one may be substituted for the other, in case of need.

There is one disease in which lemon juice appears to exercise almost a specific influence, and that is sea-scurvy. No imitation of it succeeds so well. Therefore it is a general provision for a ship's crew, and when required is given in doses of one to two ounces three or four times a day. It is supposed to do good by supplying oxygen to the system. During the last few years it has become a favourite remedy in acute rheumatism, for which it is given in doses of from ℥ss to ℥ij three or four times a day. Few medical men rely upon it for this purpose.

Prep.—Acidum citricum,—Inf. Aurant. comp.,—Inf. Gent. comp.,—Sp. Ammon. Arom.,—Syrupus Limonum.

LINIE OLEUM ET SEMINA.

The seeds and oil of LINUM USITATISSIMUM. *Common Flax.*

This is a pretty, annual plant, cultivated in almost every country, supposed to be a native of Egypt or central Asia. The seeds and the oil expressed from them are officinal. The seeds are small, shining, smooth, flattened, of a brown colour externally, white within. They have no smell, but an oily mucilaginous taste. Their cuticle contains a gummy matter, which is taken up by hot water, forming a thick viscid liquid, something like mucilage of acacia, which it resembles much in its properties, as being precipitated by alcohol, salts of lead, yielding mucic acid, when treated with nitric acid; by destructive distillation it affords ammonia, but it is uncertain whether the nitrogen is derived from the mucilage or another principle associated with it. In this mucilage, Vauquelin discovered free acetic acid, silica, and salts of potash and lime.

The parenchymatous part of the seeds abounds in oil, which may be separated by expression. The ground seeds are kept in the shops under the name of *linseed meal.* This when treated with hot water forms a soft adhesive mass, highly oleaginous, employed by chemists for luting. The cake which remains after expressing the oil, affords a nutritious food for cattle.

Medical Properties of the seed.—Demulcent and emollient; a decoction of it is useful in catarrh, dysentery, nephritis, calculous affections, strangury and inflammations of the mucous membrane of the lungs, intestines, and urinary passages. It is a useful article for enemata. The meal, with hot water, affords one of the most common poultices, as it is very readily made, and has generally a soothing effect. In making these poultices, care should be taken to procure the meal made from the seeds, from which the oil has not been expressed, instead of the powder which is so commonly sold in the shops, and is made by grinding the seeds after pressure. The meal free from oil is apt to become dry and hard upon the skin, and gives great pain in its removal.

Linseed oil is obtained by merely pressing the seeds, or by roasting them first and then using pressure; by the latter plan, the mucilaginous matter is removed, but the oil is more acrid. This oil is of a yellowish-brown colour, of an unpleasant odour and taste; it boils at 600° F., does not congeal at zero; easily becomes rancid, and has a property of drying on exposure to the air; hence is much used by painters, and in the formation of printers' ink.

Medical Properties.—It is slightly aperient, but is seldom given on account of its nauseous taste; it is serviceable in enemata. Its more common employment is that of an application to burns, mixed with lime-water.

Prep.—Cataplasma Lini,—Cat. Sinapis.

LOBELIA.

The flowering plant of LOBELIA INFLATA. *Indian Tobacco.*

This plant is an annual or biennial plant, growing freely in the United States of America, about a foot in height, with a fibrous root, an erect angular hairy stem, branched about midway. The leaves are sessile, oval, acute, serrated, and hairy. The flowers numerous, in leafy racemes, on short axillary peduncles. The segments of the calyx, linear and pointed. The corolla, five-parted, is of a delicate blue colour, with a labiate border, the upper lip in two, the lower in three segments. The fruit is an oval, striated, inflated capsule, crowned with the persistent calyx, and containing in two cells numerous small brown seeds. It flowers in July, and continues to do so till the commencement of the frost. The plant when wounded exudes a milky juice—all parts of it possess medicinal properties; but Dr. Eberle states that the root and capsules are most active. The plant is collected in August and September. It is at present imported in packages of the herb, closely pressed and enclosed in paper, weighing half a pound.

Dried Lobelia has a slight irritating odour, and when chewed at first little, but afterwards an acrid taste, very much like that from chewed tobacco, attended with a flow of saliva and nauseating effect upon the stomach. The plant yields its virtues to water and alcohol. Water distilled from it retains its acrid taste. It has not been accurately analysed.

Medical Properties.—It is emetic, occasionally cathartic, and in small doses diaphoretic and expectorant. It is also narcotic. It closely resembles the Nicotiana Tabacum in its operation. If taken incautiously, it causes violent vomiting with distressing nausea, great prostration, profuse sweating, giddiness, headache, sometimes violent purging, general relaxation, and death preceded by convulsions may ensue.

As an emetic it is too violent in its operation, too distressing and hazardous. It has been most used in asthma, and often with great success. It is given in moderate quantities, and appears to relieve by diminishing the sensibility and irritability of the nervous system, and checking the spasmodic contraction of the small bronchial tubes. It has also been used in catarrh, croup, pertussis, and other pectoral affections, but not with such success as to entitle it to a preference over other and safer remedies. It has been used in hernia in the form of injection, and acts on the system much like tobacco.

It may be given in substance, tincture, or infusion.

As an emetic, in powder, the dose is from five to twenty grains.

Dose.—Of the tinctures, ♏ xx to ʒj.

Prep.—Tr. Lobeliæ,—Tr. Lobel. Ætherea.

LUPULUS.

The dried strobiles, or catkins, of HUMULUS LUPULUS. *Common Hop.*

This plant has a perennial root, and annual climbing stems, which are commonly made to ascend upon poles in our hop grounds. It may be considered indigenous, and is also found in many European countries, and in North America. The officinal part is the fruit or strobiles, which, when fully ripe, are picked, dried by artificial heat, packed in bales and sent to market.

These strobiles consist of leaf-like scales, of a greenish yellow colour; they have a strong narcotic fragrant odour, and a bitter aromatic, slightly astringent taste. These qualities are imparted to water by boiling, but the aroma is lost if the heat be long continued. The most active part is a substance secreted by the scales, seen in the dry fruit in the form of a powder. This is named *Lupulin.*

Lupulin may be separated by rubbing and sifting the strobiles, of which it forms $\frac{1}{8}$th to $\frac{1}{10}$th of their weight. It is a fine yellow powder mixed with minute particles of the scales, from which it is freed with difficulty. It is inflammable, and when moderately heated becomes adhesive. It has the flavour of the hop. From 200 parts, Chevalier and Payen procured 105 of resin, and 25 of a peculiar bitter principle, besides volatile oil, aroma, gum, an azotised substance, and various salts. In 120 grains, Dr. Ives found—

Tannin	5
Extractive	10
Bitter principle	11
Wax	12
Resin	36
Lignin	46

The properties probably reside in the volatile oil and bitter principle.

Medical Properties. — Tonic and narcotic, useful in diseases of debility, associated with morbid wakefulness and nervous derangement.

It may be used as a substitute for opium, when the latter drug seems somewhat inadmissible. The diseases in which it is most useful are dyspepsia, and the nervous tremors, wakefulness, and delirium of drunkards, and chronic rheumatism. It may be given in substance, infusion, tincture, or extract.

Hops have also been used to stuff pillows, to tranquillise maniacal patients, and are said frequently to produce the desired effect.

Dose.—Of the extract, gr. v to gr. x.
Tincture, j to ʒij.
Of Lupuline, gr. v to gr. x.
Prep.—Tinct. Lupuli,—Extr. Lupuli.

MAGNESIÆ SULPHAS.

Sulphate of Magnesia, or *Epsom Salts.*

The latter name has been given to this salt from the circumstance of it being contained in the waters of a spring at Epsom many years ago. In this country at present, it is procured either from sea-water or Magnesian limestone. After the removal of chloride of sodium from sea-water by evaporation and crystallization, the residual liquor contains sulphate and muriate of magnesia. If this solution be evaporated, the sulphate of magnesia crystallizes with a little of the muriate, and may be separated from the other impurities. To remove the muriate, the salt should be washed with a saturated solution of the sulphate: the sulphate crystallizes, and the other drains away.

It is procured from Magnesian limestone, also named dolomite of mineralogists, consisting of carbonate of lime and magnesia, by first heating it to expel carbonic acid, then comminuting it, and adding to it some hydrochloric acid to dissolve out some lime. The residual mass is then treated with sulphuric acid, which unites with it, and forms a soluble sulphate of magnesia, and with any lime a sparingly soluble sulphate of lime, which, in minute quantity, is the only impurity found in this preparation. This is the plan pursued by Mr. Henry of Manchester.

In America magnesia is found in the state of a hydrate and hydrated carbonate, and only requires the addition of sulphuric acid; and indeed in some districts it is found native, but in small quantities. In Italy and elsewhere magnesia is found in schists, associated with sulphuret of iron. By roasting such ores a sulphate of iron and magnesia is generated, to be separated by lixiviation. The lime is added to precipitate the iron, and leave a soluble sulphate of magnesia.

Sulphate of magnesia has a bitter nauseous saline taste. It crystallizes in quadrangular prisms, terminating in a four-sided pyramid, or a dihedral summit. It is commonly in the form of acicular crystals; they contain about fifty-one per cent. of water, are soluble in their own weight of water at 60°, and in three fourths of their weight of boiling water.

Composition:

1 sulphuric acid = 40
1 magnesia = 20
7 water 7 × 9 = 63
123

Formula $MgO, SO^3, 7 HO$.

This salt is decomposed by potash, soda, and their carbonates, by lime, baryta, and strontia. The bicarbonates of soda and potash do not form a precipitate without heat.

Medical Properties.—Sulphate of magnesia is a cooling saline purgative, and with proper management a diuretic. It produces watery evacuations without much pain. It is very properly administered in fevers and inflammatory diseases, as it is also refrigerant. It possesses the advantage too of quieting the stomach, sometimes when other remedies fail, and will be retained when everything else is rejected; this is remarkably observed in some cases, in which doses of twenty or thirty grains, frequently repeated, have checked obstinate vomiting. To act on the kidneys, the surface of the body should be kept cool, and the person taking it have exercise. It is constantly added to other purgatives, such as senna, the griping qualities of which it is said to subdue. Its action is increased by being taken in a considerable state of dilution, or with a little additional dilute sulphuric acid, as half a drachm to a drachm, or with a small quantity, that is, about a sixth or fourth of a grain of tartarized antimony. The most pleasant modes of taking are either in infusion of roses, or in highly carbonated water, to which some syrup of lemons has been added.

Dose.—℥ss to ℥iss.

Prep.—Magnesiæ Carbonas.

MALVA.

The entire plant of Malva Sylvestris. *Common Mallow.*

This is a very common plant, not only in England, but in many other parts of the world.

The herb, flowers, and root have a weak herbaceous, mucilaginous taste, without any odour. They abound in mucilage, which they impart to water. An infusion and tincture of the flowers has a blue colour, and may be used as a test of acids and alkalies, being reddened by the former, and turned green by the latter.

Medical Properties.—Demulcent and emollient. The decoction may be employed in catarrhal, nephritic, or dysenteric affections, and any other cases which are relieved by mucilaginous liquids. It also forms an emollient injection; and the fresh plant affords an emollient, relaxing poultice.

Dose.—Ad libitum.

MANGANESII BINOXYDUM.

The *Binoxyde, Peroxide, or Black Oxide of Manganese* is not used medicinally. It is employed in pharmacy to assist in setting free chlorine. It exists naturally in this form, and is more abundant than any other ore of Manganese. It is used in the arts for obtaining chlorine for the purposes of bleaching, to give a black glazing to pottery, or to free glass from the colour which it derives from the peroxide of iron.

Prep.—Calx. Chlorinata, Liq. Sodæ Chlorinatæ.

MANNA.

The concrete juice of FRAXINUS ROTUNDIFOLIA and FRAXINUS ORNUS. *Flowering Ash.*

Besides being procured from this tree, manna is said to flow from many others in various parts of the world; still the substance does not exactly resemble the product of this and some of the other varieties of ornus.

The flowering ash is a tree of moderate size, growing from twenty to twenty-five feet high, and is a native of Sicily, Calabria, and Apulia. During the hot months, the juice exudes spontaneously and concretes upon the bark; and to assist the exudation, incisions are made transversely on one side of the trunk. These incisions are repeated the following year, and thus alternately for thirty or forty years. Straws or clean chips are sometimes placed so as to receive the juice which concretes upon them. It varies in appearance, according to the mode of collecting it, the nature of the season, and period of the year. The best comes from Sicily. The varieties met with in the markets are separated into three sorts:

1st. *Flake manna,* in large long flattish pieces of a light colour, on breaking presenting a shining crystalline appearance.

2d. *Common manna* is more in masses, and contains many impurities; it appears to be a mixture of portions of flake manna, with a more liquid substance of a browner colour.

3d. *Fat manna* is collected later in the season, when the weather is cooler, and there is more rain. It is less disposed to concrete, and therefore flows down the tree into hollows or receivers at the bottom. It is soft and viscous, and of a light brown colour.

Properties.—Manna has a slight odour and a sweet taste, somewhat nauseous in the browner kind. It melts with heat. When pure it is soluble in three parts of cold, and in its own weight of boiling water. Alcohol dissolves it, and if hot alcohol be saturated with manna, on cooling, it is deposited in a crystalline form. Fourcroy and Vauquelin, by analysis, discovered in it—

A crystallizable saccharine principle named *mannite,* amounting to 75 per cent.; true sugar; yellow nauseous matter, on which the purging depends; a little mucilage.

Manna when long kept and exposed to heat is apt to ferment. It is the sugar, not the mannite, which undergoes fermentation. The darker coloured manna is most purgative.

Medical Properties.—A mild laxative and purgative, and in consequence of its sweetness is a very good adjunct to more powerful medicines. By itself it is a fit medicine only for young children, as the dose to purge an adult must be large, and then would cause some flatulence and griping. The most common use of it is to add it to senna draughts.

Dose.—For a child, ʒj to ʒiv.
an adult, ℥j to ℥ij.

Prep.—Conf. Cassiæ.

MARANTA.

Arrow-root, the fæcula of the root-stock of Maranta Arundinacea.

This plant is a native of South America and the West Indies, where it is abundantly cultivated. In the West Indies, arrow-root is prepared in the following manner: The rhizomes are dug up when a year old, washed and beaten into a pulp, and thrown into water, and agitated, so as to separate the amylaceous from the fibrous portion. The fibres are removed by the hand, and a milky liquid remains, consisting of the starch suspended in the water; this is then strained in coarse linen and allowed to stand, that the fæcula may subside, which is collected, again washed, then dried in the sun. This substance is supposed to be procured from other varieties of maranta, and also from plants of different natural orders.

Arrow-root is in the form of a white powder or small pulverulent masses, without smell or taste. It is pure starch, like that procured from wheat or potatoes. It is said to be often adulterated with the starch of the latter, in consequence of the difference of expense. The fraud is of little importance, as the one is quite as good as the other, unless it be that there is a slightly unpleasant taste in that procured from the potato.

Medical Properties. — Arrow-root is nutritious and demulcent, affording a light, mild, digestible article of diet, well fitted for the sick and convalescent, very serviceable in bowel complaints and diseases of the urinary passages.

It is much used during the weaning of infants, or when the mother's milk is deficient. It is prepared for use by dissolving it in hot water, with which it forms a thick gelatinous liquid. One tablespoonful is sufficient for a pint of water. It should be first made into a paste with cold water, then the boiling water may be gradually poured upon it, and, to make it more palatable, sugar or lemon-juice may be added. For children, milk is generally employed instead of water.

MASTICHE.

Mastich, the resin of Pistacia Lentiscus. *Mastich Tree.*

This is a small tree or shrub, a native of countries bordering on the Mediterranean. The drug is chiefly collected in the island of Scio, by making incisions in the trunk and principal branches, from which the juice exudes, and either hardens in the form of tears upon the bark, or drops upon the ground where it is received upon cloths, and concretes in regular masses; the tears are most esteemed.

Mastich is almost inodorous, unless rubbed or heated, when it becomes fragrant. It has a terebinthinate taste. Alcohol dissolves four fifths of it, leaving a viscid substance, which is brittle when dried, and to which the name *masticin* has been applied. It swells up and softens, although it is not dissolved in alcohol. It is quite soluble in ether and oil of turpentine, not in any degree in water. In addition to the resin and masticin, mastic appears to contain a minute quantity of volatile oil.

Medical Properties.—Mastich is scarcely used now as a medicine. Some imagine it to be a stimulating expectorant and diuretic, and occasionally prescribe it in gleet and leucorrhœa; it has been given in debility of the stomach, and hæmoptysis from ulceration. It enters into the composition of some dinner pills as they are called, and is supposed to act merely by retarding the solubility of the other substances combined with it. In Turkey, the women chew it, to preserve the gums, and to sweeten the breath. An alcoholic solution of it is dropped into carious teeth by dentists, or the substance itself is softened and put in, and appears sometimes to give relief. The best use to make of it, is for varnishes.

Prep.—Tr. Ammoniæ composita.

MEL.

Honey, a fluid substance, collected from the flowers, and prepared by the Apis Mellifica, *Honey-bee.*

It is rather uncertain what precise part the body of the bee plays in the elaboration of honey. The elements of it no doubt are collected from the flowers, and probably assume a new form, by passing through the body of the insect. Honey, which is collected from hives that have never swarmed, is called virgin honey. The best is that which is allowed to drain from the comb. In addition to the honey of our own country, we procure it largely from France and Barbary.

Honey has a peculiar odour, which varies with the flowers from which it was collected, and a sweet slightly aromatic taste, followed by a sense of acrimony in the fauces. Cold water dissolves it readily: alcohol less so. It contains—

Crystallizable sugar; uncrystallizable sugar; an aromatic principle; an acid; wax; mannite (according to Guibourt).

The inferior honey contains a large proportion of uncrystallizable sugar and vegetable acid. Honey is adulterated sometimes with starch, to make it appear whiter and finer. This is easily detected by water, which will dissolve the honey, and the starch will fall to the bottom, and may be tested by a solution of iodine.

Medical Properties.—Honey is used in medicine chiefly to sweeten substances, in the same way as sugar. It is rather more disposed to run off by the bowels. Some call it a detergent, and thus use it in the Mel. Rosæ and Mel. Boracis.

Prep. — Oxymel, — Oxym. Scillæ, — Mel Rose, — Mel Boracis.

MENTHA PIPERITA.

Pepper-mint. The entire herb.

This is an indigenous plant, with a perennial root and annual stem. It flowers about July and August, and just before flowering should be cut down for medical use.

The herb has a penetrating strong odour, somewhat like camphor, and a warm aromatic pungent camphorous taste, attended with a sensation of coolness when air is admitted into the mouth. These qualities depend upon a volatile oil, which may be collected by distillation. The oil contains a small portion of camphor. The virtues are imparted freely to alcohol, and, in a minor degree, to water.

Medical Properties.—Peppermint is one of the best aromatic stimulants, antispasmodics, and carminatives. It relieves nausea, spasmodic pains of the stomach and bowels, and is useful to cover the taste of some unpleasant medicines. It may be used in infusion or a spirituous solution; but the volatile oil is most convenient, either alone or in preparation.

Prep.—Aq. Menth. Pip.,—Ol. Menthæ Pip.

MENTHA PULEGIUM.

Pennyroyal.

This is also an indigenous plant, possessing a strong odour and taste, much less agreeable than the former. Its virtues depend upon a volatile oil, which can be separated by distillation.

The chief and only difference in its properties, if such there be, between it and the other mints, is, that it appears to have a slight action as an emmenagogue, and with this view it is sometimes prescribed.

Prep.—Ol. Pulegii,—Aqua Pulegii.

MENTHA VIRIDIS.

Spear-mint.

This is likewise an indigenous plant, more frequently found than the other species. In appearance it closely resembles the Peppermint, but may be distinguished by the flowers being arranged more in the form of a spike, and the leaves being sessile; whereas the leaves of Peppermint are petiolate.

This plant owes its virtues to a volatile oil, which is less pungent than that of Peppermint, and to many persons more agreeable.

Medical Properties.—Similar to those of Peppermint. It is given in a similar manner, and in similar doses.

Prep. — Aq. Menth. Vir., — Ol. Menth. Vir., — Sp. Menthæ Viridis.

MEZEREUM.

The bark of the root of DAPHNE MEZEREUM. *Mezereon.*

This is a shrub, which is indigenous, growing wild in some parts of the country, and cultivated in almost every garden. It seldom exceeds three feet in height; is readily recognised by its pretty pink flowers, which open in March, and before the leaves have expanded themselves. The fruit is a berry of a red colour when ripe, oval, and containing a single seed. Other varieties of Daphne, as the

D. Laureola and *D. Gnidium*, are considered to be the sources of the drug in many instances.

The bark of the root is only officinal with us; but that of the stem is almost equally efficacious, and is met with in the shops mixed with that of the root. The berries and leaves possess also active properties, and the former have often proved fatal to children. They act as a powerful narcotico-acrid poison.

Mezereon should be in the form of thin strips, about an inch broad, partially rolled and quilled, covered with a gray epidermis, which can be easily separated. When fresh, it has a nauseous smell; but when dry, is almost inodorous. Its taste at first sweetish, is afterwards acrid, and highly irritating. It yields its virtues to water by boiling. Gmelin and Bär discovered in Mezereon—

An acrid resin, associated with wax; yellow colouring matter; reddish-brown extractive matter; uncrystallizable sugar; gummy matter, containing azote; woody fibre; malic acid, and malates.

In addition to the above, chemists have discovered a crystallizable substance, named *Daphnin*, which has an austere bitter taste. This is not the active matter of Mezereon. The acrid resin is the powerful ingredient; it is procured by boiling Mezereon in alcohol; on cooling, wax is precipitated, and then the alcohol is to be distilled off. The residue is to be washed with water, and pure resin remains. This is of a very dark colour, hard and brittle, and of an exceedingly acrid and permanent taste.

Medical Properties.—The fresh bark applied to the skin is capable of producing vesication; and, for this purpose, has been much used in the south of Europe. The dried bark, moistened with vinegar, is used occasionally with the same intention, but is not very certain in its effects. It has been introduced into ointments to irritate blistered surfaces, as a substitute for Unguentum Sabinæ.

Internally administered, Mezereon is a stimulant determining to the skin and kidneys. It is also considered to be an alterative. At one time it had the character of being antisyphilitic, and is still used for secondary symptoms. Now we give it occasionally in skin diseases, chronic rheumatism, and scrofulous affections. The decoction has been used as a gargle in atonic disease of the throat, and, if the bark be masticated, it becomes a sialogogue. It is rarely given, except in combination, as in the compound decoction of sarsaparilla.

Dose.—Gr. v to gr. x.
Of the decoction, ʒss to ℥jss.

MORI SUCCUS.

The juice of the fruit of MORUS NIGRA. *Mulberry Tree.*

This tree is supposed to be a native of Persia, and is now extended over many parts of the world. The fruit only is officinal. This is oval, of a dark reddish-purple colour. It consists of numerous minute berries united together, and attached to a common receptacle, each containing a single seed, the succulent envelope of which is formed by the calyx.

It is inodorous, has a sweet mucilaginous acidulous taste, and abounds in a deep red juice. The acid is chiefly tartaric.

Medical Properties.—Mulberries are refrigerant and laxative, and are very grateful to patients suffering from fever. An elegant syrup is made from the juice, and is a pleasant addition to gargles. It is objectionable on account of suffering decomposition very readily, from the mucilaginous matter in it. Mulberries are, however, much more employed as food than as a medicine.

Prep.—Syr. Mori.

MORPHIÆ ACETAS. (*Vide* p. 32.)

MORPHIÆ HYDROCHLORAS. (*Vide* p. 33.)

MORRHUÆ OLEUM.

The oil obtained from the liver of GADUS MORRHUA. *Cod-fish.*

This oil is procured from the liver of the cod-fish by various processes; either by placing the liver in barrels, and allowing them to putrefy, and collecting the oil which drains away from them, or by boiling the livers in water and collecting the oil which floats upon the surface, assisted at the same time by pressure.

This oil as found in the shops varies considerably in colour, taste, density, and composition. The purest is very pale, with a density slightly greater than that of olive oil. It is essentially an oleate and margarate of glycerine, containing traces of choleic acid or biliary matter, butyric, acetic, and some other organic acids, iodine, bromine, a peculiar matter named *Gaduin*, with alkaline salts. The tests which are recommended for ascertaining its purity, appear to possess little or no value.

Medical Properties.—This remedy, now in great repute, may be considered to be alterative and tonic, but not in the sense in which the latter term is used, more in the light of a nutritive agent. It is most used in phthisis, in which its benefit is best marked, by apparently checking the progress of the disease, and prolonging life. It is supposed to act chiefly by supplying combustible matter to support animal heat, and some believe that it benefits by the small trace of bromine or iodine which it may contain. It is also found useful in most scrofulous diseases, and where there is much emaciation of the body. The chief difficulty in its administration is its unpleasant flavour at first, but to which patients soon reconcile themselves. One of the most palatable modes of taking it is, floated upon common orange wine.

Dose.—ʒij to ℥j, ter in die.

MOSCHUS.

Musk, a secretion in the preputial follicle of the Moschus Moschiferus. *Musk Deer.*

This animal is an inhabitant of the central mountainous districts of Asia, extending from India to Siberia. It is exceedingly timid, and is hunted generally at night. The musk is contained in an oval hairy projecting sac, found only in the male, situated between the umbilicus and the prepuce. It is lined internally by a smooth membrane, which is corrugated and thrown into a number of folds, forming incomplete partitions. In the vigorous adult animal it contains six drachms of musk; but in the old, seldom more than two; and none in the young. It is secreted by the lining membrane, and in the living animal forms a consistent mass. At first it is probably liquid, and a portion is occasionally forced out by the animal.

Musk is imported from China, Calcutta, and Russia.

The first is the best and is known by being in rounder bags, covered with reddish-brown hairs, and containing not more than 1½ drachm to two drachms of musk, large-grained, dark, strong-scented, and having an ammoniacal odour.

Properties.—The odour of musk is so diffusive that one part communicates its odour to 5000 parts of an inodorous powder. In some persons it occasions headache and other disagreeable symptoms. The taste is bitter, disagreeable, and somewhat acrid. It is inflammable, leaving a light spongy charcoal. On analysis, it yields a great number of proximate principles, which are ammonia, stearin, elain, cholesterin, an acid oil with ammonia, a volatile oil, muriates of ammonia, potash, and lime, gelatin, albumen, fibrin, carbonated matter soluble in water, carbonate and phosphate of lime, hair and sand. By the same analysis it yielded 47 per cent. of volatile matter, chiefly ammonia. Other chemists have found a less quantity. This however varies, as well as the solubility in different menstrua. From 50 to 70 parts per cent. are soluble in water, and from 25 to 62 in alcohol. Sulphuric ether is a good solvent: the watery infusion has a reddish-brown colour, a strong odour, and an acid reaction. Potash added to musk, disengages ammonia. If carefully preserved in bottles, musk retains all its virtues for a very long period.

Musk is very often adulterated, in consequence of its high price. For this purpose dried blood is much used, also sand, lead, iron-filings, hair, animal membrane, wax, benzoin, storax, asphaltum, and many other substances, so blended with real musk that the odour does not appear altered. Musk, which burns with difficulty, has a feeble odour, a colour either pale or deep black, feels gritty to the fingers, is very moist, or contains other obvious impurities, should be rejected.

Medical Properties.—Musk is stimulant and antispasmodic, increasing the action of the heart and appearing to rouse the nervous energy without producing any marked cerebral symptoms. It relaxes spasm in some cases in a decided manner: the diseases in which it is most properly given, are those in which there is a prostrate condition of the system, with great nervous agitation or irregular muscular action; such as low typhus, with subsultus tendinum; tremors and singultus. It has been found useful in gout in the stomach, and other spasms of that organ; in obstinate hiccough, convulsions of children depending upon disorder of the intestines, tetanus in large doses, epilepsy, hysteria, asthma, pertussis, cholera, and colic.

The high price of the substance precludes its free and general use, even admitting that it has powerful virtues. It may be given in substance in the form of pill, or in mixture suspended by mucilage, or in the form of tincture.

Dose.—Gr. x to gr. xx.
Of the mixture, ℥j.
Prep.—Mist. Moschi.

MUCUNA.

The hairs on the pods of MUCUNA PRURIENS. *Cowhage.*

This plant has an herbaceous annual stem, and a perennial root. It entwines itself upon trees in its neighbourhood. It grows both in the East and West Indies. The fruit is a coriaceous pod, shaped like the italic letter *S*, about four inches long, and covered with brown bristly hairs, which easily separate, and stick to the fingers when handled, causing a most intolerable itching. The pod only, covered with the hairs, is imported. In some Pharmacopœias the plant is described as a variety of Dolichos, in others, of Stizolobium.

Medical Properties.—Cowhage is only used as an anthelmintic, for the removal of either tænia, lumbricus teres, or Ascarides. Its action is purely mechanical, and it is remarkable that it does not irritate or inflame the mucous membrane of the bowels. The spiculæ pierce the worms, and either kill them or cause them to be detached from their nidus in the mucus. An objection raised against it is, that it causes intolerable irritation about the anus and fauces. This I cannot subscribe to, as I have known many cases in which cowhage has been given without any complaint of the kind being made. There may be a little tickling in the fauces, which can be removed by eating some bread and drinking some mucilaginous liquid. The mode of giving it is to mix up the hairs pretty thickly with treacle or syrup, and to let the patient (if a child) take a teaspoonful of it every morning: and an adult may take a tablespoonful: a purgative should be administered every third day. It has been suggested, rather absurdly, to rub cowhage on the body in poisoning by opium, to rouse the patient. This operation would be too disagreeable to the attendants to admit of being practised.

Dose.—Gr. v to gr. x.

MYRISTICA ET MYRISTICÆ OLEUM.

The Nutmeg, the kernel of MYRISTICA MOSCHATA, and the oil expressed from the *Nutmeg*.

The nutmeg-tree has a very handsome appearance, somewhat resembling the orange-tree, and grows to a height of 25 to 30 feet. The fruit, which is officinal, is round or oval: of the size of a small peach, with a smooth surface, at first green; when ripe, yellow, and marked with a longitudinal furrow. This opens and separates into two portions, disclosing a yellowish-red reticulated membrane or arillus, commonly called *mace*, closely investing a brown shining shell, which contains the kernel or nutmeg. There are several varieties of it cultivated in the East Indies.

This tree is a native of the Moluccas, and is abundant in the group named Banda Islands. It is now cultivated at Sumatra, Java, Penang, and some other parts of the East Indies; and has also been introduced into the Isle of France and Bourbon, and some of the West Indian islands.

In the Moluccas, there are three gatherings or crops of nutmegs in the year. When the fruit is gathered by the hand, the outer part is removed and rejected as useless; the mace is then separated, flattened, and dried in the sun, and subsequently sprinkled with salt-water, to assist in its preservation. The nuts are dried in the sun or by ovens, till the kernels rattle in the shell. They are then broken open, and the kernels having been removed are steeped in a mixture of lime and water, probably to preserve them from the attack of worms; then cleaned, and subsequently packed in chests or casks for exportation.

Properties.—The interior of the nutmeg is of a yellowish [illegible] [illegible], with reddish-brown branching irregular veins, which give it a marbled appearance. These dark veins abound in an oily matter, upon which the medical properties depend. The odour of nutmegs is fragrant, the taste warm, aromatic and pleasant. The virtues are extracted by alcohol and ether. From 500 parts, M. Bonastre procured—

White insoluble fatty matter	[illegible]
Liquid fat	[illegible]
Volatile oil	[illegible]
Acid	[illegible]
Starch	[illegible]
Gum	[illegible]
Lignin	[illegible]
Loss	[illegible]

The volatile oil which may be procured by distillation is of a pale straw-colour, and possesses strongly the flavour of the nutmeg. It is lighter than water, but by agitation in water is separated into two parts, one sinking, the other remaining on the surface.

By pressure, with heat, the kernel affords an oily matter which becomes solid on cooling, and is commonly, although improperly, called *oil of mace.* It is a mixture of fixed and volatile oil.

Nutmegs are sometimes deteriorated by having been heated and punctured to extract the volatile oil, which can be done without any visible change in the appearance of the surface. This is called sweating them. They should be rejected when light, of a feeble taste and smell, or worm-eaten.

Mace has a taste and odour very like nutmeg. It contains a volatile and fixed oil, a large quantity of gummy matter, like amidine and gum, and a small quantity of lignin; the best mace is not brittle, should be rather dark coloured, and have a strong smell and taste.

Medical Properties.—The nutmeg is principally used as an aromatic, but it possesses at the same time narcotic qualities. In large doses it causes stupor and delirium, and cases are recorded where it is thought to have produced a fit of apoplexy, consequently it should be avoided by persons who have any tendency to that disease. It is used to cover the taste of other medicines, and more freely as an agreeable addition to farinaceous food or drinks, in cases of languid appetite or delicate stomach. It is reduced to powder, by grating, for common use. The properties of mace are similar.

Dose.—Gr. v to gr. xx.
Of volatile oil, three to five drops.

Prep.—Conf. Aromat.,—Sp. Amm. Arom.,—Tinct. Lav. comp.,—Sp. Myristicæ,—Ol. Myristicæ,—Empl. Picis.

MYRRHA.

The Gum Resin of BALSAMODENDRON MYRRHA. *Myrrh Tree.*

The tree from which Myrrh was procured for a long time was unknown: we are indebted for a knowledge of it to Ehrenberg, who found it growing in Arabia Felix, and found upon it the Gum-Resin. The tree also grows in Abyssinia. It is rather of a small size, covered with a greyish bark, from which the myrrh exudes.

The varieties of myrrh in the market are known as East Indian and Turkey. The former is conveyed to India from Abyssinia, the latter finds its way through Egypt, and is by far the best.

Properties.—Myrrh is in irregular shaped pieces, sometimes in tears, of a reddish-brown colour, translucent when very good, of a peculiar strong aromatic odour, and a bitter aromatic taste. It is brittle and pulverizable; it is partially soluble in water, alcohol, and ether: according to the analysis of Brandes, 100 parts of myrrh contain—

Of volatile oil	2·60
Soft bitter resin, soluble in ether	22·24
Tasteless resin insoluble in ether	5·56
Gum, with traces of salts	54·38
Bassorin	9·30

Besides salts of potash and lime, water, and impurities.

The volatile oil can be obtained separate by distillation, and carries with it most of the aroma of myrrh.

Medical Properties.—Myrrh is stimulant and tonic, and is considered by some to be expectorant, antispasmodic and emmenagogue; whatever be its virtues nobody gives it alone. It is always associated with other medicines, either to moderate or assist their action, such as preparations of iron or aloes. The diseases in which it has been most given, are phthisis, chronic catarrh, bronchitis, and asthma, and pectoral affections generally, where mucus is secreted and there is insufficient power to expel it, chlorosis, and amenorrhœa. It is a good application to spongy gums in the form of tooth-powder, or the solution as a wash for them. Myrrh may be given in substance or tincture or suspended in mixtures by mucilage.

The tincture of myrrh of the Pharmacopœia is made with rectified spirit, and consequently holds the resin and oil in solution; when this is added to water it makes a turbid liquid, and by degrees most of the myrrh is separated. This tincture is an agreeable addition to liquids for gargles.

Dose.—Gr. v to gr. xv.

Prep.—Tinct. Aloes c.,—Mist. Ferri comp.,—Pil. Al. c. Myrrh,—Pil. Ferri c.,—Pil. Rhei c.,—P. Galb. c.

NUX VOMICA.

The seeds of STRYCHNOS NUX VOMICA.

The tree is of a moderate size, a native of the East Indies, growing in Malabar, Ceylon, and many other parts. The wood and root are very bitter, and are used in India for the cure of intermittents. The fruit is a round berry, of the size of an orange, covered with a smooth yellow rind, and containing within, a soft pulp, and several seeds. The seeds only are officinal with us. These seeds are flat, circular, somewhat like buttons, nearly an inch in diameter, with a velvety covering of very delicate fibres attached to a fragile coating, which invests the interior nucleus or kernel. They are very hard, requiring to be rasped, before they can be powdered. Their taste is intensely bitter. They impart their virtues to water and alcohol. In nux vomica Pelletier and Caventou discovered two alkaloids, named strychnia and brucia, associated with igasuric acid, recently named strychnic. The other constituents are yellow colouring matter, concrete oil, gum, starch, bassorin, and a small quantity of wax. The active principles are the alkaloids.

Strychnia is found not only in this nut, but likewise in the bean of St. Ignatius, which contains it in a much larger proportion, and unmixed with brucia. This substance crystallizes in prisms, is permanent in the air, inodorous, but excessively bitter, so much so that it communicates a decided bitterness to 600,000 parts of water. It is soluble in 7000 parts of water at 50 and 2500 of boiling water. Alcohol dissolves it sparingly when cold, freely when heated. Its ultimate elements are O^4, H^{22}, N^2, and $C^{42} = 334$.

Strychnia is very rarely found perfectly pure, in which state it is not coloured by nitric acid. The strychnia usually sold is turned yellow by this acid, but brucia acted upon by nitric acid yields a rich deep red colour. From the researches of Dr. Tuss, it would appear that brucia is not a distinct alkaloid, but rather a combination of strychnia with resin, which is the cause of the red colour, with the nitric acid. Its usual formula, however, is—

$C^{44}\ H^{26}\ N^2\ O^7$, Liebig.

Medical Properties.—Nux vomica, and of course strychnia are tonic and stimulant, showing their effects most on the nervous system, especially the motor nerves of the spinal chord. In large doses it is a very powerful poison, and therefore requires in all cases to be administered with great caution. The diseases in which it is given are paralysis, intermittents, chorea, epilepsy, dyspepsia, dysentery, mania, and hypochondriasis. The diseased state in which it is most likely to do good is paralysis, and particularly when it is of a partial character and not immediately depending upon the brain, as paraplegia, and the palsy, which attacks the arms of those persons who work with lead, as painters and others. It does not appear to act much on the brain. When it is taken by a paralytic person, and begins to produce an effect, a sensation of tingling, heat, and pricking is felt in the paralysed part, and the muscles contract involuntarily, producing a kind of subsultus tendinum; whilst this is going on, the healthy parts may not be, and usually are not, in any degree affected: having arrived at this point, we must desist from increasing the dose, and indeed rather diminish it. Should its use be discontinued, and subsequently resumed, we must recommence with the small doses, and not with those the patient took when he left it off. By not attending to this, some persons have lost their lives. In larger doses it causes tetanic contractions of the muscles of the body, and by affecting those of respiration, prevents the changes of the blood, and asphyxia and death ensue.

Some have explained its fatal operation, by stating that it exhausts the irritability of the heart, but this is not borne out by facts; others imagine that it partly kills by contracting the small branches of the arteries, and thus overloading the heart: whenever it occasions a constriction of the abdomen, tightness of the chest, heat in the stomach, and violent spasmodic contraction of muscles, a brisk purgative should be given, and the medicine be discontinued for a day or two. Paralysis of the bladder, incontinence of urine from paralysis of the sphincter, and amaurosis, are said to have been often relieved by it.

Nux vomica may be used in the form of powder or the alcoholic extract prepared from it, or strychnia, which act in a similar manner, but is by far more powerful.

Dose.—Of the powder, gr. iij, to be gradually increased.
Of the extract, gr. $\frac{1}{4}$ to gr. ij.
Of strychnia, gr. $\frac{1}{16}$th, to be very cautiously increased. It can seldom be given in more than $\frac{1}{4}$-grain doses.

Brucia acts in a very similar manner to strychnia, but is much less active. It is estimated that twelve grains are only equal to one grain of strychnia, so that about a grain may be given for a dose.

Prep.—Strychnia,—Extr. Nucis Vomicæ.

OLIVÆ OLEUM.

The oil expressed from the drupes of the OLEA EUROPÆA. *Olive tree.*

This tree is a native of the Levant and south of Europe, where it is most abundantly cultivated, forming groves which have been much celebrated by poets and historians. It grows to a height of from 15 to 20 feet, bearing fruit at the second year of its growth, and will continue to do so for at least one hundred years. The fruit, the portion for which the olive tree is cultivated, is a smooth oval drupe, of a green or violet colour, with a fleshy pericarp, and a very hard nut of a similar shape.

In the state in which the fruit is first gathered, it is exceedingly acrid; but when macerated in water, or an alkaline solution, and afterwards put into a solution of common salt, it becomes mild and a pleasant article of diet. The pericarp abounds in a fixed oil, which constitutes its greatest value. The oil is procured by bruising the olives in a mill, and then submitting them to pressure. The best oil, called *virgin oil*, is obtained from the fruit before it is ripe, and immediately pressed. It is known by its greenish hue. The common ordinary oil is procured from very ripe olives, or from those which have afforded the virgin oil. The commonest oil is from fruit which has been thrown into heaps, and allowed to ferment for several days, or from the residue left after obtaining the better oil, broken up, exposed to fermentation, and again pressed. The best oil is brought from the south of France, though, to the oil generally, we apply the term Florence oil.

Good olive oil has scarcely any smell, but a bland, rather sweet taste. It is lighter than water, begins to concrete at 38 F. At 32 F. the margarine is solid, and the elain may be separated by pressure, or by the action of alcohol, which will dissolve it, and leave the concrete principle.

When exposed to the air, it is apt to become rancid, and acquires a disagreeable smell, a sharp taste, thicker consistence, and a deeper colour; and the change is promoted by heat.

Medical Properties.—Olive oil is nutritious and mildly laxative, and is given sometimes in cases of irritable intestines, where more active remedies cannot be given, and sometimes as a substitute, although mild, for castor oil. It is useful where strong alkalies have been taken as poisons, by forming a soapy and comparatively inert compound. It has been recommended for worms, which it is imagined to destroy, as it does insects, by blocking up the respiratory pores, and is a common ingredient in laxative enemata. It is much used externally to sheath irritated surfaces from the action of the air, and is employed as a vehicle or diluent for more active substances. The most extensive use made of it is, in pharmacy, as a constituent of liniments, ointments, cerates, and plasters.

Dose.—As a laxative, one to two ounces.

OPIUM.

The inspissated juice of the unripe capsule of the Papaver Somniferum.

This plant is presumed to be a native of Asia, but is now cultivated in Europe, even in our own country. There are two varieties which afford opium, known as the white and black poppy. The plant is annual and herbaceous, with a smooth stem, rising to a height of three feet, and, in favorable situations, still more. The flowers are large and polypetalous, the calyx is disepalous, the leaves large, ovate, sessile, and irregularly dentate. The seed vessel is a capsule, which is smooth, glaucous, of a rounded form, about two inches in diameter, somewhat flattened at the top and bottom, crowned with the persistent stigma, the diverging segments of which are arranged in a circle upon the summit. It contains numerous white seeds, which, when ripe, escape through small openings beneath the stigma. In the black poppy, the seeds are of a darker colour.

All parts of the fresh poppy yield a white milky juice, which, however, does not contain the active principles of the opium. It is the capsule which yields the juice, in which the virtues of the plant reside. The dry capsule retains only a small portion of active matter, still sufficient to cause them to be used medicinally. The seeds are destitute of narcotic qualities, and are even used as an article of food. They abound with a bland oil, which may be separated by pressure, and may be used for the same purposes as olive oil. It is much in use in France, where the plant, in some departments, is cultivated for its seeds alone. The poppy does not appear to elaborate its potent principles before a certain period of its growth, for we are told that in Persia the young plant is often used as a mild pot-herb. For the production of opium, it is cultivated most extensively in Turkey, Egypt, Persia, and India.

Opium is procured in the following manner, which resembles the process employed from the remotest periods in which the use of this drug is mentioned. The unripe capsules, about half-grown, are selected for the purpose. In the evening, about sun-set, longitudinal and oblique superficial incisions are made in the capsule, by an instrument which can only cut to a certain depth; during the night the juice exudes, and is scraped off in the morning, and put into proper receivers, in which it is exposed to the sun to concrete, and when sufficiently inspissated is worked into masses by the hand, and covered with the leaves of a variety of dock, or of the tobacco plant. The incisions are repeated upon the same capsules several times in the course of a fortnight, till the whole of it has been scarified. The evening is selected to favour the exudation, for the heat of the sun in the day would soon dry up the juice, and naturally impede its escape. In this manner, opium, of an excellent quality, has been procured in our own country and France; and from the analysis made of it, might be used with equal effect and in not much smaller doses. The growth of it has been discontinued in consequence of the difficulty experienced in its sale, solely by virtue of foolish prejudice. Another mode of obtaining opium is reported to have been, that of bruising the unripe capsules, expressing the juice and evaporating it to a proper consistence. Such a preparation has not more than half the strength of our general specimens of opium.

We obtain our supply of opium principally from Turkey and Egypt, in a very limited extent from Persia and India. Most of the Indian opium is consumed by its inhabitants or exported to China, where it finds a ready market. Turkey opium is raised chiefly in the province of Anatolia, and is shipped from Smyrna. It comes to us in masses of an irregular size and form, more or less flattened, covered with leaves and the reddish capsules of a species of rumex. According to Dr. A. T. Thompson, nearly one fourth of opium consists of impurities, amongst which we find sand, ashes, the seeds of plants, the extracts of poppy, glycyrrhiza glabra, and chelidonium glaucum, gum, tragacanth, small stones, minute pieces of lead or other metals.

The varieties of Turkey opium, described by Guibourt, are the *Smyrna, Constantinople, and Egyptian.*

Smyrna opium is in variable sized masses, much flattened from the original softness, covered with seeds of a rumex; becoming black and dry in the air; of a strong odour. It is most esteemed, but is liable to be mixed with a kind of opium in balls or round masses, which are hard and of an inferior quality.

Constantinople opium is in small, flattened, somewhat regular lumps, from two to two and a half inches in diameter, always covered with poppy leaf, the middle nerve of which marks the middle of the mass. Its odour is weaker than in the former variety. It blackens and dries in the air.

Egyptian opium is in regular masses, somewhat larger than the former, bearing the impress of having been carefully moulded. It is covered with the vestiges of a leaf. It is distinguished by its redder colour, its weaker odour, and by softening instead of drying in the air. It has a shining surface, and is somewhat adhesive to the fingers. Notwithstanding the high authority for the above characters of distinction, implicit reliance cannot be placed in them. Opium varies considerably in appearance, at different periods, and will be found very often not to correspond with the description given of it.

Good opium has a peculiar strong narcotic odour, and a powerful acrid taste. When long chewed it excites a tingling of the lips and mouth, and a flow of saliva, and may even blister the mouth in those not accustomed to it. Its colour is reddish brown; in the centre, when soft, nearly fawn coloured. Its texture should be compact and uniform. It readily inflames, if applied to a lighted paper. It is partially soluble in water, alcohol, ether, acetic acid, wine, or lemon juice, to which it imparts a deep brown colour. Triturated with hot water, five parts in twelve are dissolved, six suspended, and one not affected. Cold water will take up about twelve parts in sixteen, but these proportions will be found to vary in different specimens.

The discovery of most of the proximate and active principles of opium has not been long made; and even in the present day, it is highly probable that some still remain unknown, to be detected hereafter, by the further progress of chemistry. Opium is said now to contain—

Morphia; codeia; thebaia; paramorphia; pseudomorphia: narcotine; narceine; meconine; meconic acid; gum; resin; extractive;

a fixed oil; caoutchouc; odorous matter; woody matter; several salts, as of lime, potash, &c.

The most important and valuable of these principles is morphia.

Morphia exists in opium in combination with meconic acid, and possibly sulphuric, which give it solubility. It may be procured by the process ordered in the London Pharmacopœia. It is in the form of transparent crystals, is almost insoluble in ether, most soluble in hot alcohol, which takes up $\frac{1}{30}$th of its weight. It is soluble in the fixed and volatile oils, a solution of potash and soda, and many of the acids. It is composed of—

Formula $C^{35} H^{20} NO^{6} = 292$.

The crystallized morphia contains two equivalents of water.

The tests of morphia are the following:

Nitric acid turns it of a red colour, afterwards yellow.

Iodic acid, being added to morphia, is decomposed; the mixture becomes brown by the disengagement of some iodine, which will form the characteristic blue colour by the addition of starch. No other alkaloid will decompose iodic acid, setting free the iodine.

Sesquichloride of iron turns morphia and its neutral salts of a blue colour.

Many other tests are spoken of by authors, but are too uncertain in their indications to be of much value. Pure morphia is not used medicinally, in consequence of its insolubility in water. If it meets with acids in the stomach, it will be dissolved, and thus be powerful in its action. It is most used in combination with hydrochloric and acetic acid; the quantity of morphia in opium is said to be nearly 10 per cent., but according to Brande, one pound of opium will yield 500 grains of morphia, whilst others state that only about 7 drachms of morphia are contained in the pound.

Meconic acid exists in the poppy only, partly in combination with morphia, partly in a free state. It is procured from the meconate of magnesia, formed by adding magnesia to a solution of opium. This meconate is decomposed by a soluble salt of baryta or lead, and meconic acid is separated from the lead by hydrosulphuric acid, and from baryta by sulphuric acid.

Of crystallized meconic acid.

Formula $C^{14}\,HO^{11},\ 3\,HO + 6\,HO$.

In a pure free state, meconic acid is in the form of white micaceous scales. It is soluble in water and alcohol. It is decomposed by hot water, and is converted into metameconic acid; and by dry heat is turned into pyromeconic acid. It is inert, and, of course, is not used medicinally. The tests of its presence are the following:

The *Persalts of Iron* produce a red colour, occasioned by the formation of permeconate of iron.

Sulphate of Copper produces a yellowish-green precipitate.

The *Chloride of Gold* throws down a purple precipitate, if a little potash has been previously added.

Codeia is an alkaloid discovered in the year 1830, by Monsieur Robiquet. It is white, crystalline, solid, sparingly soluble in cold water, more so when hot; soluble in ether. It unites with acids and forms salts. It differs from morphia in not forming a blue colour with the persalts of iron, and is reported not to be reddened by nitric acid. Ammonia does not precipitate it from its solution with hydrochloric acid.

Thebaia, another alkaloid found in opium, does not form large crystals, like codeia, and differs from morphia in not being soluble in alkalies or reddened by nitric acid.

Narcotine is a crystalline substance, very soluble in ether, very sparingly so in water. It has no alkaline reaction, although it is capable of uniting with acids. Its salts are very bitter; they redden litmus, and form precipitates with infusion of galls and alkalies. In medical virtues, narcotine is very deficient. It was at one time supposed to be the stimulating principle of opium, but experiments have shown that such an opinion was erroneous.

Narceine is a white crystalline solid, discovered by M. Pelletier in 1832. Its precise nature is not satisfactorily known. It is distinguished by the action of sulphuric, muriatic, and nitric acids upon it, which evolve a bright blue colour. It also produces a bluish colour with iodine. It does not produce a blue colour with the persalts of iron. It has little sensible effect upon the body.

Meconine also is a white solid, of an acrid taste, sparingly soluble in cold water, much more so in boiling water. It is characterised by its fusibility, greater solubility, forming a colourless solution with dilute sulphuric acid; after fusion becoming of a blood-red colour, if chlorine gas be passed over it. It is of no service as a medicine.

Paramorphia, discovered by Pelletier in 1835, is the substance previously named *Thebaine.* It is a white crystalline solid, acrid to the taste, very soluble in ether and alcohol, almost insoluble in water. It has an alkaline reaction, and forms salts with acids. In composition it appears isomeric with morphia, but differs from it in the persalts of iron, not forming a blue colour, and not being reddened by nitric acid. Majendie says that its action on the body is like that of brucia and strychnia.

Pseudo-Morphia has only been occasionally met with by Pelletier. The account given of it is so imperfect that it leaves room to doubt whether it is not morphia slightly modified by some occasional deviation in the analytical processes.

In the recent works on chemistry and materia medica, some of the above-mentioned proximate principles have received new names, causing much confusion. It is very doubtful whether they all exist in the opium ready formed, or some of them may not be educts of the processes employed to obtain them.

Tabular arrangement of the chief proximate principles of opium according to Mr. Phillips.—

Morphia	$C^{35} H^{20} NO^{6}$.
Codeia	$C^{36} H^{21} NO^{6}$.
Thebaia	$C^{25} H^{14} NO^{3}$.
Narceia	$C^{28} H^{20} NO^{12}$.
Papaverina	$C^{40} H^{21} NO^{12}$.
Pseudomorphia or Phormia . .	$C^{24} H^{18} NO^{12}$.
Porphyroxin of Opium, composition unknown.	
Meconin	$C^{20} H^{9} O^{7} + HO$.
Narcotin	$C^{46} H^{25} NO^{15}$.
Meconic acid (crystals) . . .	$C^{14} H^{11}, 3 HO + 6 HO$.

Medical Properties.—Opium is a stimulant anodyne, soporific, hypnotic, antispasmodic, indirectly sedative, diaphoretic, antiperiodic, and astringent. When taken in a moderate dose by persons in health, it soon increases the force and frequency of the pulse, raises the temperature of the skin, augments muscular action, elevates the spirits, and excites fresh vigour in the intellectual faculties. This excitement may even extend to a state resembling intoxication or delirium. In a short time the excitation subsides, and is followed by calmness of the corporeal actions and an exquisite placidity of mind: this is succeeded by drowsiness and sleep. The sleep is sometimes composed, at others disturbed by frightful dreams, so much so that poets and painters have taken opium on account of the extraordinary scenes which it raises up for the imagination. After a sleep of some hours the person awakes with a feeling of nausea, headache, and tremors, which will last for some time. Such are the common effects if opium be taken in a moderate dose. Amongst the therapeutical effects and peculiarities of its action, there are some deserving peculiar attention. All the secretions of the body are checked by opium, except of the skin; the peristaltic action of the intestines is arrested; pain and inordinate muscular contraction are subdued; and general nervous irritation is relieved.

When large doses of opium are taken, the stage of excitement is shorter, and the narcotic depressing effects are more obvious and alarming.

Opium taken in poisonous doses soon operates on the system; it speedily reduces the frequency of the pulse, diminishes muscular strength, brings on drowsiness, and almost an apopletic sleep. At the commencement, the breathing is stertorous, there is suffusion of the eye, a full labouring pulse, almost total insensibility to external impressions, sometimes violent agitation, confused state of intellect, and, if roused, an irresistible desire to sink into a comatose sleep. The pulse is sometimes so full and powerful in its beat as to advise the use of the lancet. In the space of a few hours these symptoms are changed, and a state of great debility and danger shows itself. It is in this condition that medical men are often called to persons who have taken opium in poisonous doses. The countenance is then pallid, the skin and extremities cold and clammy, the pulse small and weak, the pupil contracted, the breathing slow, quiet, and somewhat gasping; there is almost total insensibility; and, unless treated by active measures, the patient soon dies.

The morbid appearances in poisoning by opium are very insufficient to account for death—the vessels of the brain are gorged, and there is sometimes an inflammatory appearance in the mucous coat of the stomach, which, however, is supposed, in the majority of instances, to have been more caused by the remedies than the poison itself. It appears to act on the nervous system by a sedative influence, and possibly by actual contact, resulting from its absorption.

The general effects of opium in medicinal doses may be obtained by introducing it into the rectum, or applying it to the surface of the body, especially where the cuticle is removed. In this way it appears to cause less general excitement than when given by the mouth. Its local action presents the same character as when it is taken internally. It first produces increased action of a part, then a diminution of sensibility and contractility. These effects are observed more rapidly the larger the quantity in which the opium is applied.

In some countries opium is eaten largely as an article of luxury, and a substitute for intoxicating liquor. This is the case in Turkey, Persia, Hindostan, and China. The quantity taken is enormous, and in time becomes less powerful to the stomach, the sensibility of which is gradually destroyed. Such individuals are the most wretched and miserable objects, emaciated, enfeebled, and, when deprived of their opium, unfit for the least mental or bodily exercise.

As a stimulant and excitant, opium must be given in small doses. For this object we employ it in low typhoid complaints, in confluent smallpox with great prostration, extensive suppurations, as in phlegmonous erysipelas, especially when with these there is combined restlessness with want of sleep. In these cases it exalts the action of the nervous and vascular system, and may be advantageously given with other stimulants.

As an anodyne, opium is our most valuable remedy. It relieves pain very speedily and effectually. It may be given in most painful diseases, which are not attended with high inflammatory action. We give it in cancer, colic, passage of gall-stones. As a narcotic, or hypnotic, we depend upon it more than any other remedy. It is prescribed in many diseases for this purpose, where morbid vigilance exists, independent of any inflammation of the brain. Amongst the most important, is the delirium tremens of drunkards, in which it is sometimes sufficient to effect a cure. It produces sleep by its direct operation on the brain, and also by allaying that nervous irritation on which the wakefulness so much depends.

As an antispasmodic, opium is highly useful in tetanus, colic, spasm of the stomach, in gout, spasm in the uterus, spasms of the biliary ducts in the passage of calculi, and various convulsive affections.

It is very efficacious in checking morbid discharges, which it accomplishes, probably, by allaying irritation in parts, and subduing the action which supported them. Thus, it benefits in diarrhœa, chronic catarrh, humoral asthma, diabetes, and some forms of hæmorrhages. As a diaphoretic, opium is not very certain when given alone. It acts best in combination with ipecacuanha and tartarised antimony, as in Pulvis Ipecacuanhæ compositus, and other formulæ. Dovers' powder may be said to act by the ipecacuanha relaxing the exhalants, and the opium forcing the blood into the relaxed vessels.

Whatever be the disease in which opium is used, it should be recollected, as a general rule, that it is contra-indicated in a highly inflammatory condition, or plethora, or where there is determination of blood to the head, or the secretions are locked up. It is improper in constipation of the bowels, with one exception, and that is colic, in curing which opium is sometimes called an indirect purgative. In this disease it overcomes the spasm of the muscular fibres, and thus makes a passage for castor-oil or other purgatives.

It would be a tedious task to enumerate all the diseases in which opium is prescribed, for there are very few in which it may not be given in some of their stages. It is often given in inflammations of serous membranes; not on account of its own peculiar virtues, but to control and aid the action of other remedies. Thus, given with calomel in peritonitis, it acts by preventing the calomel running off by the bowels. It does this by checking the secretion of bile which calomel has a tendency to increase. Given, after a full bloodletting, in acute diseases, in a full dose, with a large dose of calomel, it acts as a sedative, and effectually prevents reaction. It has been given in large doses a short time before the cold stage of intermittent fevers, and has often succeeded in preventing the paroxysm. In this case it probably acts by relaxing the capillaries, retaining the blood in them, and consequently obviating congestion in the large venous trunks. Amongst the secretions which are diminished by opium, that of the liver is most remarkable. In this respect, it operates in direct opposition to calomel. The evacuations of persons taking opium are likely to be clay-coloured, and will continue so, with the use of opium, for a long time. Acquainted, as we are, with the necessity of the liver performing its functions duly, it is not surprising that the abuse of opium should be seriously detrimental to the health and vigour of the system.

Some of the preparations from opium, such as Battley's sedative solution, and the salts of morphia, act more kindly and certainly than opium. They stimulate less, and cause less distressing symptoms in the head the day after; besides, they are more decidedly sedative and act with greater certainty. About a quarter or a third of a grain of the acetate or hydrochlorate of morphia is considered equal in effect to one grain of opium. Care should be taken that they are obtained from respectable vendors, for the price of them holds forth inducements to adulteration. It is convenient to keep a solution of these salts in water, so contrived, that it represents the strength of tincture of opium, as now adopted in our Pharmacopœia.

Opium varies much in its relative effects upon the body at different ages; in children it requires to be given in small doses and with great caution. Elderly people also feel its effects more than the vigorous adult. In a child of twelve months old, it is dangerous to exceed the dose of one minim; and, indeed, when infants take it, it would always be more safe to reduce this dose, and let it be repeated until it produces the desired effect. The ordinary dose of opium for an adult is one grain, equivalent to twenty minims of the tincture, but this may be extended to three grains or more, in very painful spasmodic diseases.

In tetanus, 20 and 30 grain doses have been given with scarcely any effect. The dose must also be modified by the habits of individuals, for an opium-eater can take as much for one dose, with impunity, as would kill half a dozen ordinary persons.

In cases of poisoning, the treatment to be pursued consists in washing out the stomach by the aid of the stomach-pump: administering tonic stimulating emetics, giving tea and coffee to rouse the system, awakening the patient by exercise, dashing cold water on the head and epigastrium (which will also aid the vomiting), and even by any other plan which may suggest itself. If there is great exhaustion, ammonia and even brandy may be given. In some cases bloodletting is necessary; generally it is objected to, as it is supposed to be likely to give rise to increased absorption of opium into the system. On the following day bloodletting is often requisite, followed by purgatives and antiphlogistic remedies.

A discovery of opium by tests is not a very easy matter. The poison is likely to be entirely thrown off, and it does not permeate the tissues like mineral poisons; when it is known to exist, the morphia and meconic acid are to be obtained in a separate state, and the proper tests be applied to each. There are few cases in which the existence of opium in persons poisoned by it has been ascertained with ease and certainty.

Doses of opium:

As a stimulant, gr. ¼ to gr. ½, three or four times a day.
As an anodyne, soporific, or hypnotic, gr. j.
As a sedative and antispasmodic, gr. j to gr. iij.

Preparations:

Morphia, not used as a medicine.
Morphiæ acetas, dose gr. ¼ to gr. 1.
——— Hydrochloras, the same dose.

Confectio Opii; about thirty grains of it contain one of opium. It is a stimulating preparation of opium.

Emplastrum Opii, an anodyne plaster, useful in pleurodynia, neuralgic and chronic inflammatory affections.

Enema Opii; four ounces contain thirty minims of tincture of opium.

Extr. Opii purificatum, given in the same doses as opium; it is less stimulating.

Linimentum Opii.

Pilulæ Ipecacuanhæ compositæ.

———Saponis compositæ; five grains contain one grain of opium.

Pulv. Cretæ c. cum Opio; there is one grain of opium in two scruples.

Pulv. Ipecac. comp.—commonly known as Dovers' Powder,—has one grain of opium in ten grains, which quantity is the usual dose.

Pulv. Kino comp. contains a grain of opium in a scruple.

Tinct. Camph. comp. contains nearly a grain of opium in half an ounce.

Tinct. Opii contains about a grain in twenty minims.

Vinum Opii is of nearly the same strength as the tincture.

OVUM.

The egg of the Phasianus Gallus. *Common Barndoor Fowl.*

The egg may be divided into four parts, for the sake of description: 1st, the shell; 2d, the white semi-opaque membrane, liding the inside of the shell; 3d, the white; 4th, the yolk. The shell consists, according to Vauquelin, of carbonate of lime, with a little animal matter, phosphate of lime, carbonate of magnesia, oxide of iron, and sulphur. By exposure to great heat, the lime is left almost pure.

The lining membrane of the shell is albuminous. The white of the egg, according to Bostock, consists of 12 parts of albumen, 2·7 of mucus or uncoagulable matter, 0·3 of saline substances, including soda, with a trace of sulphur, and 85 of water, in 100 parts.

The yolk contains water, albumen, a mixed fixed oil, and colouring matter, with sulphur and phosphorus.

Properties.—The shell may be powdered and levigated, and administered as an antacid in diarrhœas and dyspepsia. The white is often used to clarify liquids, which it does by involving substances during its coagulation. It is a valuable antidote for corrosive sublimate; agitated with a piece of alum, it is coagulated and at the same time dissolves a portion of the alum, thus forming the alum curd, a cooling application to the eye in ophthalmia.

The yolk is supposed by some to be laxative, but without sufficient reason. It is a light nutritive substance, acceptable to the stomach, and easily digested. In pharmacy it is much employed for mixing with water, insoluble substances, such as resins, balsams, oils, &c.

Prep.—Mistura Spir. Vini Gallici.

PANIS.

Bread made from Wheat.

This variety of bread is made properly from wheat flour, yeast, salt, and water; but it is a common practice in London to add a portion of potatoes to make the bread light, and to assist fermentation; and, besides, alum is added to make the bread look white and to assist in the absorption of water. During the fermentation which occurs in making bread, sugar is decomposed and converted into carbonic acid and alcohol, which flies off, and part of the starch is converted into dextrine and sugar.

Bread is used in pharmacy in the preparation of poultices, and sometimes to assist in the formation of pills.

PAREIRA.

The root of the CISSAMPELOS PAREIRA.

This tree or shrub grows like a vine in Brazil and the West Indies. The root only is officinal. It is in hard, solid, dark coloured pieces, varying from a quarter of an inch to two inches in diameter, wrinkled on the surface, and of a dark-brown colour. It has no odour, but a slight taste, which is bitter, and at the same time a little sweet. It contains—

Soft resin; yellow bitter matter; brown matter; animal matter; fæcula; acid malate of lime; nitrate of potash; some other salts in small quantity.

Water extracts all its active qualities.

Medical Properties.—Said to be tonic, aperient, and diuretic, and has been given in calculous diseases, ulceration of the kidneys and bladder, leucorrhœa, dropsy, rheumatism, and jaundice.

Dose.—Of the powder, ʒss to ʒj, or it may be given in the form of decoction.
Of the extract, gr. v to gr. xv.
Prep.—Decoct. Pareiræ,—Extr. Par.

PAPAVER.

The ripe capsules of Papaver Somniferum.

For the production of the dry capsules, poppies are cultivated in this country. The white poppy is most employed, but occasionally we meet with the black variety, of which the seeds are of a dark colour, but do not differ essentially in properties. They contain principles somewhat similar to those of opium, which they yield to water by decoction. The seeds contain a bland fixed oil, which is much used in France; triturated with water, they form a white, milky, pleasant emulsion.

Medical Properties.—These capsules, analogous to opium in medical properties, are exceedingly feeble. They are often used in the form of decoction as an emollient anodyne fomentation, or in the form of syrup, or extract, to calm irritation, promote rest, and to procure narcotic effects.

Syrup of poppies is a remedy much given to children to compose them, and as it is very variable in its strength, and in large doses injurious, requires some consideration n using it; when carefully made, from two to three rachms are equivalent in effect to one grain of opium; ut, if carelessly prepared, possibly an ounce or two would not be equivalent. Some druggists make it with the extract of poppies, others with tincture of opium, so that very rarely can it be depended upon. It would be better to lay it aside altogether. The extract may be said to differ from opium in being less stimulant, less likely to confine the bowels, or produce the head symptoms which follow generally the use of opium: from eight to ten grains are considered equal to a grain of opium.

Dose.—Of the extract, gr. v to gr. x.
Of the syrup, for an adult, ʒij to ʒiv.
For an infant, ten to twenty minims; but it is better never to give it.

PETROLEUM.

This substance belongs to that class of bodies named bitumens. They consist almost entirely of hydrogen and carbon. Petroleum is found at Amiani, near Parma, at Gabian, in France, on the borders of the Caspian sea, in the kingdom of Ava, in Barbadoes, Trinidad, and other West India Islands. The wells in Ava are said to afford 400,000 hogsheads annually. The petroleum from Barbadoes only is used officinally.

Qualities.—Barbadoes tar is a black, thick, viscid liquid, possessing a bituminous taste and strong odour. It is very combustible. Sp. gr. ·730 to ·878. By distillation it affords naphtha, and a solid residue, called asphaltum.

Medical Properties.—It is a stimulating expectorant, antispasmodic, and sudorific. It has also been administered as an anthelmintic, and used externally as a stimulating embrocation, in chronic rheumatism, pains of the joints, and paralysis.

Dose.—From 10 to 30 minims in any convenient vehicle.

PHOSPHORUS.

This substance can scarcely be considered officinal in its uncombined state; it is mentioned on account of being used in making the dilute phosphoric acid.

Phosphorus is best obtained by calcining bones, by which we have remaining phosphate of lime, with a little carbonate of lime. To this sulphuric acid is added, which produces a comparatively insoluble sulphate of lime, and a soluble superphosphate. The latter is removed and evaporated to the thickness of a syrup, and then mixed with half its weight of powdered charcoal. To this mixture, in a proper apparatus, heat is applied and carried to redness; phosphorus passes over and is condensed in water, and subsequently melted and poured into a mould to assume its usual shape. In the latter part of the process, the charcoal decomposes the phosphoric acid, uniting with its oxygen, and forming carbonic acid, which, with the lime, forms carbonate of lime, and the phosphorus is set at liberty.

Phosphorus is insoluble in water, is dissolved sparingly by alcohol and oils; is more soluble in ether.

Medical Properties.—Phosphorus in very small doses is a powerful, general stimulant; in large doses a violent irritant poison. It appears to act most electively on the urinary and genital organs, and has been given in dropsy, impotency, typhus, phthisis, marasmus, chlorosis, paralysis, amaurosis, &c. It is rarely used in this country. The plan of administering is to dissolve three grains of it in an ounce of ether, and begin with about ten minims for a dose. As its action is very powerful, its effects should be very carefully watched.

Prep.—Acid. Phos. dil.

PIMENTA.

Allspice.—The dried unripe berries and oil of EUGENIA, *alias* MYRTUS PIMENTA. *Pimento Tree.*

This is an elegant tree, about thirty feet high, evergreen, and bearing a profusion of flowers. The fruit is a spherical berry, crowned with a persistent calyx, and when ripe has a black or dark purple colour. The tree exhales an aromatic fragrance, especially when it is in flower. It is a native of the West Indies, Mexico, and South America; most abundant in Jamaica. The berries only are officinal. They are gathered after they have attained their full size, but still green, and are dried in the sun. They contain two cells, each having a black hemispherical seed. These berries possess a fragrant odour, likened to a mixture of cinnamon, cloves, and nutmegs, whence their name *allspice*, by which they are generally known. Their taste is warm, aromatic, and pungent; their flavour is imparted to water, and completely to alcohol. By analysis, M. Bonastre discovered in them—

Volatile oil; green fixed oil; oleaginous substance in yellow flakes; tannin; gum; resin; uncrystallizable sugar; malic and gallic acids; saline matters, moisture, and lignin.

The volatile oil is the aromatic principle, the green oil occasions the acridity. The external portion contains twice as much of these oils as we find in the internal parts.

Medical Properties.—A warm aromatic stimulant, forming an agreeable adjunct to tonics and purgatives, to cover their taste, increase their warmth, and be more acceptable to the stomach, especially in cases where there is much flatulence and griping. Allspice is more used as a condiment than as a medicine.

Dose.—Gr. v to gr. x. Of the distilled oil three or four drops.

Prep.—Aq. Pimentæ,—Spiritus Pimentæ,—Syrupus Rhamni,—Ol. Pimentæ.

PIPER CUBEBA.

Cubebs.—The berries of PIPER CUBEBA, or CUBEBA OFFICINALIS.

This is a climbing perennial plant, a native of Java, where it grows luxuriantly in the woods. It flourishes also in the Isles of Bourbon, and France, and in Guinea. The fruit is a berry which grows in clusters, and is officinal. Cubebs are round, of a blackish colour, wrinkled on the outside, and have a pedicle attached, whence the name of tailed pepper. The shell is hard, almost ligneous, containing within it a loose seed, covered with a blackish coat, and internally white and oleaginous. The odour is aromatic, the taste warm and camphorous, leaving a sensation of coolness in the mouth, something like peppermint. Vauquelin found in cubebs—

Volatile oil; a resin in odour and taste like copaiba; a brown resin; a coloured gummy substance; extractive matter; saline matter.

The oil may be obtained separate by distillation. It has usually a green colour, is rather viscid, and has a strong camphorous taste. Cubebs should not be kept in the state of powder, as they become gradually very weak; but they should be preserved entire, and be powdered only when required.

Medical Properties.—This pepper is stimulant, diuretic, stomachic, and carminative. It is rarely used but in gonorrhœa, gleet, and leucorrhœa; in the cure of which it has great reputation. As it stimulates considerably, it is more rational to prescribe it after the inflammatory stage has passed over; yet, there are many who give it from the very commencement of a gonorrhœa. The unpleasant effects of it occasionally are nausea, vomiting, headache, severe purging, sometimes with bloody discharges.

The *modus operandi* of this drug in gonorrhœa is explained in several ways, viz., it acts either by entering the urine, to which it gives a peculiar odour, and stimulating by direct contact the mucous membrane of the urethra, producing in it a new action; or by revulsion, causing a great flow of blood and nervous energy to the mucous membrane of the alimentary canal, which idea is somewhat strengthened by the fact that cubebs is most beneficial when it causes a smarting in the rectum, and a peculiar sensation of coolness after evacuating the fæces. Cubebs given injudiciously and largely, appear sometimes to bring on inflammation of the testicles.

Dose.—ʒj to ʒiij, mixed up with some bland liquid.
Of the volatile oil, x to xx drops.
Of the tincture, ʒj to ʒij.

PIPER LONGUM.

The dried unripe fruit of PIPER LONGUM.

This variety of pepper is readily known by the shape of the fruit, which consists of a number of very small one-seeded grains or berries, imbedded in a pulpy matter. It is a native of South Eastern Asia, very abundantly produced in the neighbourhood of Bengal. The fruit is green when unripe, becoming red as it ripens; in the former state it is more pungent, and is gathered to be dried in the sun.

Long pepper is cylindrical, about an inch in length, with a weak odour, and a pungent burning taste. It contains piperine, a concrete oil on which its acrimony depends, and a volatile oil.

Medical Properties.—The same as of black pepper; as a spice, it is less esteemed, and is seldom used.

Prep.—Conf. Opii,—Pulv. Cretæ comp.,—Tinct. Cinn. comp.,—Pulv. Cinnam. c.

PIPER NIGRUM.

The berries of PIPER NIGRUM. *Black Pepper.*

The pepper vine is a perennial plant, growing wild in

Cochin-China and various parts of India, and is cultivated on the Malabar Coast, Malacca, Sumatra, Java, and many other places. The best pepper is said to come from Malabar, although the largest supplies are derived from Sumatra and Java. It also grows in the West Indies.

The vine is propagated by cuttings, and is supported by props, or trees planted for the purpose, upon which it is trained. In three or four years from the period of planting, it begins to bear fruit. The berries are gathered before they are ripe, and are dried in the sun.

White pepper is the ripe berry deprived of its skin, by maceration in water and subsequent friction, and afterwards dried in the sun. It is not quite so pungent as the black pepper, although it sells at a much higher price.

The dried berries are externally blackish and wrinkled, internally whitish, of an aromatic smell, and a hot, pungent, fiery taste. They yield their virtues partially to water, completely to alcohol and ether. Pelletier found them to contain—

A crystalline matter named *Piperine;* an acrid green concrete oil; a balsamic volatile oil; a coloured gummy substance; extractive matter; bassorin; tartaric and malic acids; lignin and various salts.

Piperine when pure is in colourless transparent crystals, without taste, insoluble in water, soluble in alcohol, ether, and acetic acid; is decomposed by the strong mineral acids. It is obtained from pepper, chiefly by the agency of alcohol. The taste and pungency of pepper depend on the concrete and partly on the volatile oil.

Medical Properties.—Black pepper is a warm stimulant and carminative, acting on the system generally, but most so on the part to which it is applied. It is extensively employed as a condiment, for which purpose it is given to stimulate the stomach and prevent flatulence. It has also been used in cases of piles in the form of Ward's paste, and is thought to do good by stimulating the torpid vessels of the alimentary canal. Intermittents are said to have been cured by it, and possibly may be in weak debilitated habits, where starvation has prostrated them; to such persons, a generous diet with cordials and stimulants may give vigour to the system, and stop the disease. Some have attributed the good effects to piperine, but probably without sufficient reason, for it appears that piperine in a pure state is totally inert and useless.

Dose.—Gr. v to gr. xx.

Prep.—Conf. Pip. Nigr.,—Con. Rutæ.

PIX BURGUNDICA.

Burgundy pitch in its pure form is said to be obtained from Thus, the Abies Excelsa, by melting and straining the exudation of that tree, which is named Thus or Frankincense. That which is found in the shops is generally a fictitious article, of which common resin is a large ingredient.

Use.—Externally applied, it is an irritant and rubefacient even to an alarming extent in some irritable subjects.

Prep.—Empl. Cumini,—Empl. Picis.

PIX LIQUIDA.

Tar.—The prepared liquid resin of the Pinus Sylvestris and some other species of Pine.

The mode of procuring tar is to cut the wood into billets and pile it up, and cover it over with some turf, then prepare a cavity at the bottom, communicating with a little ditch surrounding it. The wood is then ignited at the top, and the heat thus applied causes the liquid to exude, and run down to the bottom, where it is collected and put into barrels.

Tar has a strong odour, a bitter resinous taste, a black colour, and a thick consistence. It is composed of *pyretine*, *pyroleine*, *acetic acid*, and water; and according to some authors, all the proximate principles of coal tar, besides *colophony* and *oil of turpentine*. It yields some of its constituents to water, which thus form the once celebrated tar water. By heat the liquid parts are evaporated, and leave a solid matter, named *Pix nigra*.

Medical Properties.—Stimulant and expectorant. Its action is very like that of the turpentines generally. It is only to be given in chronic cases, such as chronic bronchitis or catarrh. Formerly this was a favorite medicine in phthisis, but now is abandoned. Some skin diseases would appear to have been benefited by its use, and recently an author has published his opinion that it is the best remedy in lepra and some other scaly diseases. Externally applied, it is often employed for tinea capitis, and as an application to indolent ulcers.

Dose.—Gr. x to gr. xxx, ter die; or tar water may be administered, as ordered in the Dublin Pharmacopœia.

Prep.—Ung. Picis liquidæ.

PIX NIGRA.

Black Pitch.—The solid prepared resin of PINUS SYLVESTRIS.

This is obtained from tar, by heating it, to expel the liquid constituents. It is used chiefly, externally, in the form of ointment, but may be given in the form of pills in doses of gr. x to gr. xxx, ter in die.

Prep.—Ung. Picis Nigræ.

PLUMBI CARBONAS.

Carbonate of Lead or White Lead.—This substance may be prepared by two methods; first, by transmitting carbonic acid through a solution of the subacetate, by which we have formed the acetate of lead and a carbonate which is precipitated. The second process is a slower operation, and is managed in the following manner: lead is first cast into thin sheets, then loosely rolled up, and placed in an earthen pot, containing a little vinegar, having within it projecting parts of the pot, on which the lead is supported without touching the vinegar. Pots thus prepared are placed in sheds, in horizontal layers, each being covered with a piece of board, on which tan from the tan-pits is strewed. These are allowed to remain undisturbed for about six weeks, at the end of which time the lead is found almost entirely converted into a white substance, viz., the carbonate of lead. This is scraped away from the metallic lead, ground in water, and reduced to a very fine powder. The mode of its formation is not thoroughly understood. The tan fermenting, causes a temperature sometimes as high as 140 to 150 degrees, which may occasion part of the acetic acid to rise and be decomposed, oxidizing the lead, and supplying carbonic acid to unite with the oxide; some carbonic acid is probably derived from the vegetable matter. White lead is usually in lumps, which can easily be rubbed into a very fine powder. It has no smell, and very little taste. It may be easily distinguished by its weight, and by the effect of sulphuretted hydrogen upon it, which instantly turns it of a brownish black colour. It is an anhydrous compound, consisting of—

1 carbonic acid = 22
1 protoxide of lead = 112
———
134

Medical Properties.—Carbonate of lead is not administered internally; if it were, its action would be astringent and sedative to such an extent as probably to cause fatal obstruction in the intestinal canal. It is sometimes applied externally to inflamed and excoriated surfaces, either sprinkled on, or in the form of an ointment. Nurses occasionally use it in this way for excoriations about the anus of infants, a practice which is very dangerous, as the lead may be absorbed and exert its sedative influence, and be the cause of death. Many cases are recorded where such consequences have ensued.

Of the various preparations of lead, the carbonate is considered to be the most poisonous; and, indeed, Dr. Thomson states, that no other form of lead becomes deleterious till it is converted into the carbonate. The effects of this substance gradually taken into the body are colic, paralysis of the extremities, especially of the right hand, general debility, and a pallid sickly appearance. In cases of colic from lead, the best treatment is to give a full dose of calomel and opium, and in half an hour follow it up with a large dose of castor oil. The bowels should be kept freely open by repeated doses of sulphate of magnesia and senna. The lead appears to paralyse a portion of the muscular apparatus of the intestines, thus suspending the peristalic action, and causing a stoppage of the fæces, above which there is a collection of flatus, and consequently severe pain; sometimes a portion of the bowels is considerably contracted. Admitting the truth of Dr. Thomson's opinion and practice, persons who are engaged in operations where white lead is used ought to take daily a good share of vinegar, to convert any portion of lead into an acetate.

PLUMBI OXYDUM.

The semivitreous Oxide of Lead.

This substance is a monoxide, commonly called protoxide of lead, rendered crystalline by fusion. It is most frequently procured from argentiferous galena. By fusing this alloy and the exposure to the air, the lead becomes oxidized and melts, forming a stratum, which floats upon the fused mass. This is allowed to run off into a proper receiver, which, upon cooling, crystallizes in small scales, constituting the litharge.

Litharge is in the form of small brilliant vitrified scales, some red, others yellow. It is devoid of taste and smell. It slowly attracts carbonic acid from the air, which is the cause of the effervescence sometimes observed when acetic acid is added to it. Two varieties of litharge are met with, the yellow with a silvery appearance, sometimes named Litharge of Silver; the other red, known as Litharge of Gold, or Red Litharge.

Pharmaceutical Uses.—It is not used internally as a medicine, but is employed in pharmacy to make the lead plaster and acetate of lead. In the arts it is much used, as for glazing pottery, as an ingredient in flint glass, and by painters to render oils drying.

Prep. — Acetas Plumbi,—Liq. Plumb. Diac.,—Cerat. Saponis,—Empl. Plumbi.

POTASSÆ BICARBONAS. (*Vide* p. 66.)

POTASSÆ BITARTRAS.

Bitartrate of Potash. *Cream of Tartar.*

This salt is obtained from the impure tartar of winecasks, by dissolving it in boiling water, decolorizing with charcoal, and allowing the salt to crystallize on cooling and by evaporation.

The crude tartar is named *Argol*, of which there are two varieties, according to the character of the wines from which it is deposited; namely, the white and the red. It consists of bitartrate of potash, a little tartrate of lime, and colouring matter, with some other trifling impurities. This acidulous salt exists naturally in tamarinds and the grape; in the latter dissolved by the means of the sugar and mucilage. When the grape juice is fermented the sugar and mucilage are decomposed, and the alcohol formed is unable to hold this salt in solution, which explains the cause of its being deposited.

Bitartrate of potash, crystallized and pure, is imported in large quantities from France, and lately from Trieste. It requires ninety-five parts of cold water for solution, and is insoluble in alcohol. Its solubility in water is very much increased by a little borax. It is scarcely ever pure, generally containing at least 6 per cent. of tartrate of lime. Crystallized cream of tartar consists of—

2 tartaric acid	2 × 66 =	132
1 potash		48
1 water		9
		189

The general view taken of this salt by chemists at the present time is, that it contains one equivalent of tartaric acid $C^8 H^4 O^{10}$ with one equivalent of potash, and one equivalent of basic water, and it is named the acid tartrate of potash, whilst the neutral tartrate is composed of one equivalent of the bibastic acid and two equivalents of potash.

Medical Properties.—This salt is purgative, diuretic, and refrigerant. It is given in many diseases to answer these several indications. In small doses it acts as a laxative, and in large ones becomes a hydragogue cathartic. It is seldom given alone; generally in combination with jalap or scammony, when we wish to promote copious watery stools, as in dropsies. Its diuretic action is supposed to depend upon the potash entering the circulation and stimulating the kidneys to increased secretion. It may here be observed that when neutral salts containing a vegetable acid act as diuretics, the acid appears to be separated or digested in the intestines, and the alkali only passes into the circulation; and that when a neutral diuretic salt contains a mineral acid, it enters the circulating mass without decomposition. This salt is much used as a cooling drink, dissolved in water, sweetened with sugar, and flavoured by oil of lemons; and is known by the name of Imperial. Jalap and bitartrate of potash form an excellent purgative and diuretic for the dropsy which succeeds scarlatina.

Dose.—As a diuretic, ʒss to ʒj, several times in the day.
As a cooling laxative, ʒij to ʒiv.
As a hydragogue cathartic, ℥ss to ℥j.

Prep.—Acid. tart.,—Pulv. Jalapæ comp.,—Ant. Potassio-tart.,—Sodæ Potassio-tart.,—Potassæ Tartras.

POTASSÆ CARBONAS.

Carbonate of Potash, used in medicine, is procured from *pearlash* by dissolving it in water, filtering and evaporation, to obtain it in a solid form. It is always sold in the form of granules, never crystallized, the cause of which is that from its deliquescent nature it would always absorb moisture from the air and would not solidify, and therefore to obtain it in its usual form, whilst drying it, heat is kept up by a sand bath, and the substance is constantly stirred with an iron rod; and hence its granular state. It is very deliquescent, and requires to be kept in a closely stoppered vessel. Its qualities, according to the London Pharmacopœia, are these, viz., it deliquesces in the air; nearly the whole of it is dissolved in water; the solution strongly changes the colour of turmeric to brown; when it has been supersaturated with nitric acid it throws down no precipitate with carbonate of soda, chloride of barium, or nitrate of silver, thus showing the absence of lime, sulphates, or chlorides. 100 grains of it by a brisk fire lose 16 per cent. of water. An equal quantity of sulphuric acid added to it evolves 26·3 per cent. of carbonic acid. It should be kept in a stoppered vessel.

Medical Properties.—This salt of potash is given in most of the cases where liquor potassæ is prescribed. It is antacid, and as such is used in dyspepsia with acidity of stomach; it is diuretic, and may be given in the uric acid diathesis, or as a lithontriptic. It is somewhat caustic and must be given in moderation. It is most used in fever draughts, in combination with citric or tartaric acid. It is beneficial in gout, and is a popular remedy in hooping-cough, combined with cochineal, in which disease it probably does good by entering the blood, and attenuating the mucus formed from it, and rendering its expulsion more easy.

Dose.—Gr. x to gr. xxx.

POTASSÆ CARBONAS IMPURA.

Impure Carbonate of Potash, formerly subcarbonate. *Pearlash.*

This substance is procured ordinarily by the incineration and lixiviation of land plants. The product obtained on a large scale is very impure, and of a dark colour; when prepared with more care, and the combustible matter is more completely removed, it becomes whitish, and is named Pearlash. The different parts of the same vegetable afford variable quantities of potash. Woody plants furnish less than herbaceous, the trunk less than the branches, and these less than the leaves. Potato stalks, bean stalks, the varieties of fumitory, artemisia, and the ferns, would yield a larger portion of potash, but are not sufficiently abundant, and would not pay for the trouble of extracting it in our country, as we get the salt from abroad at a cheap rate. It is to the potash of the wood ashes that the ley used for washing in the country owes its virtues, although the persons employing it are little aware of the cause. It is prepared in the following manner: wood-ashes are put into a cloth spread over a strainer, and supported over a large tub; upon these ashes water is poured, which in passing dissolves the potash, and precipitates the lime which was in it, and gave it a hardness; thus the ley is a more excellent solvent of the soap, and requires a less quantity of it for washing.

In a commercial point of view, pot and pearlash are made in countries where wood abounds, as in Canada and the United States. It is produced in large quantities in Russia and the shores of the Baltic, and is generally known by the names of Russian, Dantzic, American, &c.

Pharmaceutical Uses.—Pearlash is never used in medicine, in consequence of its impure state, but is employed in pharmacy to obtain the pure carbonate of potash.

POTASSÆ CHLORAS.

This salt, formerly named Oxymuriate of Potash, is procured by transmitting chlorine through a solution of carbonate of potash, to which some lime has been added. In this case five equivalents of potash are decomposed; five of oxygen with one of chlorine, form chloric acid; and this, with one equivalent of potash, forms chlorate of potash, which crystallizes very readily: five equivalents of chlorine with five of potassium form five atoms of chloride of potassium. The chlorate, crystallizing first by evaporation, is easily removed from the solution.

Medical Properties.—Its use, internally, is very limited; it may be considered to be somewhat diuretic. During late years it has been given in cholera, to improve the quality of the blood, which it is supposed to effect by imparting oxygen. With the same object it has of late been administered in low typhoid fevers. The disease in which it has been employed with the greatest efficacy is scarlatina, in combination with hydrochloric acid. This combination is employed by many medical men under the name of the chlorine mixture, which I prescribe in the following manner:

℞ Pot. Chloratis, ʒj;
Acid. Hydrochl. dil., ʒj;
Syr. Aurant., ℥ss;
Aq. Distill. ad. ℥viij.

One ounce of this to be given to adults every five or six hours, less in proportion to children. This mixture should be given early; it appears to prevent and at least to relieve the sore throat, diminishes the high fever, prevents typhoid symptoms, and its use is seldom followed by renal dropsy. This mixture is much used by some in the treatment of typhus fever, and is prescribed by many now in the treatment of diphtheria. Chlorate of potash is also said to be very useful in aphthæ. By chemists it is much employed for procuring oxygen gas.

Dose.—Gr. v to gr. xv.

POTASSÆ NITRAS.

NITRATE OF POTASH. *Saltpetre, Nitre.*

This salt is found naturally, and is prepared artificially. In many countries it exists in the soil, as in some parts of Europe, Egypt, and Peru, and effloresces on the surface, and is found in the greatest abundance in the East Indies. In the latter the soil is lixiviated, and the solution is evaporated in shallow pits, until the salt crystallizes: when the salt is mixed with nitrate of lime, potash is added, by which a nitrate of potash is formed and lime is thrown down.

In Germany and some other parts, nitre is made in nitre beds, which are formed of animal and vegetable remains mixed with calcareous matter and ashes, heaped up under sheds, and exposed to the air. This mixture is occasionally sprinkled with urine. At the end of two or three years, nitric acid is formed and combines with the potash, and is separated by lixiviation; there is at the same time a little nitrate of lime and magnesia, which are decomposed by carbonate of potash, producing nitrate of potash, and the earth is precipitated. In France much nitre is procured from old plaster rubbish, which affords, by lixiviation, nitrates of potash and lime, and chloride of sodium. The solution of these, by evaporation, affords a crust on the surface, which is chiefly the common salt, and is removed. The remainder is treated with carbonate of potash; when double decomposition ensues, a carbonate of lime is formed and precipitated, and nitrate of potash is left in solution, and by evaporation is obtained in crystals.

Nitrate of potash crystallizes in hexangular prisms with dihedral summits, is soluble in between four and five times its weight of cold water. It undergoes no change in the atmosphere, unless it be very moist; has no water of crystallization, but has generally water lodged between its particles. The most common impurity in saltpetre is common salt, which can be discovered by dissolving it in water and testing with nitrate of silver.

Medical Properties.—Nitre is refrigerant, sedative, and diuretic, and is much used in inflammatory diseases, and is said also to be antiseptic. It generally promotes the secretion of urine and perspiration, lessens the heat of the body, lowers the pulse, and has a tendency to keep the bowels in a relaxed condition. It acts as a diuretic by getting into the blood and escaping by the kidneys without decomposition. This is proved by finding nitrate of potash in the urine, either by dipping paper into it, then drying and burning the paper, when the deflagrating qualities of the nitre are perceptible; or, by evaporating the urine, the nitre may be procured in a crystalline state. In fevers, nitre is much employed with tartar emetic and bitartrate of potash, forming together a most excellent antiphlogistic remedy. It is given in larger doses in hæmorrhages, in which it restrains the flow of blood, chiefly by its sedative action; and is valuable in inflammatory sore throat, either allowed to dissolve in the mouth or in the form of gargle.

Nitre is a favorite remedy with some in acute rheumatism, during which they give it in quantities of from one to two ounces dissolved in a large quantity of water, to be taken during the twenty-four hours. The effects are very depressing; there is often a discharge of bloody urine and stools, and the cure is not very rapid, if it succeeds. It is supposed to do good by acting on the blood, possibly attenuating and diminishing the amount of fibrine.

As nitre causes a determination of blood to the kidneys and other urinary organs, it should not be given when they are inflamed, as it aggravates the symptoms considerably, and often induces bloody urine and strangury. If this salt be taken accidentally in very large doses, it will occasion inflammation of the bowels and urinary organs. To combat these, copious demulcents should be administered, and subsequently opium and cordials.

Dose.—Gr. x to gr. xv. As much as one and two drachm doses have been given successfully in cases of hæmorrhage.

Prep.—Acid. Nitric.,—Ung. Sulphuris c.

POTASSÆ SULPHAS.

Sulphate of potash, known by the popular name of *Sal Polychrest*, is usually procured from the salt remaining after the distillation of nitric acid. The excess of acid is removed from the bisulphate by the aid of heat, and the remaining sulphate is dissolved in water, then evaporated and crystallized. The crystals are very beautiful, being six-sided prisms with double pyramids.

Formula KO, SO^3. Atomic number 88.

Qualities.—It is insoluble in alcohol, sparingly soluble in water. It produces a yellow precipitate with bichloride of platinum, and a white one with chloride of barium. The latter is insoluble in nitric acid.

Medical Uses.—Purgative, often given with rhubarb. It is useful in Dover's powder to assist in minutely dividing the opium, itself being very hard.

Dose.—ʒij to ℥ss.

POTASSÆ TARTRAS.

Tartrate of potash, also named soluble tartar, is made by boiling carbonate of potash with bitartrate in water. There are two modes of explaining the chemical action; either the excess of acid in the bitartrate combines with the potash of the carbonate, forming neutral tartrate of potash, carbonic acid flying off; or, it may be stated that the potash of the carbonate takes the place of the basic water of the acid tartrate, thus forming a neutral salt, consisting of one equivalent of bibasic tartaric acid, and two equivalents of potash.

Composition according to the latter view:

1 tartaric acid = 132
2 potash 48 × 2 = 96

228

Formula $2\,KO, C^8\,H^4\,O^{10}$.

Medical Properties.—Purgative, and generally given in combination with other snbstances, as rhubarb, senna, &c.

Dose.—ʒiij to ʒvj.

POTASSII FERRO-CYANIDUM.

This salt is also named PRUSSIATE OF POTASH, and FERRO-CYANATE OF POTASH.

This salt is not used in medicine. In pharmacy, it is employed for the preparation of hydrocyanic acid. It is usually in beautiful yellow crystals, in the shape of four-sided tables, which are derived from a primary octoedron.

The salt is made on a large scale, by heating to a point of moderate ignition an iron pot, and throwing into it pearlash and dry animal substances, such as hoofs and horns, bullock's blood, &c. The mixture, as it calcines, assumes a pasty form, during which time it should be stirred up briskly. When ammoniacal and fetid vapours have ceased to escape, the mass is removed with an iron ladle. When this substance is treated with water, and the solution is filtered by evaporation, it will afford yellow crystals of ferro-cyanide of potassium. The crystallized salt contains three equivalents of water; in an anhydrous state, the following is supposed to be its composition:

1 iron		= 28
2 potassium	2 × 40	= 80
3 cyanogen	3 × 26	= 78
		186

Formula 2 KCy, FeCy + 3 HO or $K^2, C^6 N^3, Fe + 3 HO$.

POTASSII IODIDUM. (*Vide* p. 67.)

POTASSII SULPHURETUM.

Sulphuret of Potassium is made in the following manner: *Ingredients:*

Sulphur.
Carbonate of potash.

Decomposition.—When these substances are heated together, the carbonic acid is first expelled, and three fourths of the potash are decomposed, and resolved into oxygen and potassium; the oxygen combines with a fourth of the sulphur to form sulphuric acid, which, with the undecomposed potash, forms sulphate of potash; the remaining sulphur combines with the potassium, forming sulphuret of potassium; the resulting substance is a mixture of one equivalent of sulphate of potash, and three of sulphuret of potassium.

Qualities.—When recently broken, it has a yellowish brown colour. Dissolved in water, or almost any acid, it emits an odour of hydrosulphuric acid. Its solution in water is yellow. The precipitate thrown down by acetate of lead is at first red, afterwards black. By long keeping it is decomposed, and by absorbing oxygen is converted into sulphate of potash, and no longer will evolve hydrosulphuric acid when treated with water or acids.

Medical Uses.—This substance should not be given internally, being poisonous even in moderate doses. It is employed in the form of baths or lotions in some skin diseases, and especially the itch.

PRUNA.

Prunes, the dried drupes of the Prunus Domestica.

The fruit of the plum tree, when ripe, is exposed to heat in an oven, and subsequently dried in the sun. Prunes are chiefly imported from the south of France, and an inferior kind from Germany. They contain uncrystallizable sugar, malic acid, and mucilaginous matter.

Medical Properties. — Mildly laxative and nutritious. They may be stewed with water, and the liquid added to purgative decoctions. If taken largely, they are apt to occasion flatulence and severe gripings. They form an ingredient in laxative confections.

Prep.—Conf. Sennæ,—Prunum Præparatum.

PTEROCARPUS.

The wood of the Pterocarpus Santalinus. *Red Saunders-wood.*

The tree which affords this wood is of a considerable size, growing in the mountainous districts of India. The wood is brought over in large billets of a blood-red colour, compact, heavy, and of a fibrous texture. It is kept in the shops in the form of small chips, raspings, or coarse powder.

Red Saunders-wood has little smell or taste. It imparts its colour to ether and alcohol, but not to water. The colouring principle has been named *santalin;* it is of a resinous nature, is slightly soluble in fixed and volatile oils, excepting those of lavender and rosemary, which readily dissolve it. It has no medicinal virtues, and is only used on account of its colour.

Prep.—Tinct. Lavand. comp.

PULEGIUM. (*Vide* MENTHA.)

PYRETHRUM.

The root of the ANACYCLUS PYRETHRUM, or ANTHEMIS PYRETHRUM, Pellitory of Spain.

The root of this plant is perennial, but the stem is annual, and it is a native of Barbary, the Levant, and south of Europe. The dried root is imported in pieces of about 3 or 4 inches in length, of a grayish brown colour, externally; it is wrinkled longitudinally; whitish within, hard and brittle. Its taste is slight at first, but afterwards it causes an acidulous, saline, acrid sensation in the mouth and fauces, which lasts for a long time, and is attended with a copious flow of saliva.

The pungency depends on the fixed oil, which is closely allied to a resin, named Pyrethrin.

Medical Properties.—It is powerfully irritant, but used almost exclusively as a sialogogue in toothache. With the same intention it was formerly prescribed in headache, rheumatic affections about the face, and as a local stimulant in paralysis of the tongue and fauces, and relaxation of the uvula. The mode of using it is to chew a piece for several minutes; and some employ it in the form of decoction or tincture. It is a remedy seldom had recourse to in this country.

QUASSIA.

The wood of PICRÆNA, *alias* QUASSIA EXCELSA. *Bitter Ash.*

This tree is a native of Jamaica and the Caribbean Islands. It grows to a considerable height, sometimes as much as one hundred feet. The wood is used officinally. Another variety of quassia, named *amara*, affords a wood possessing similar properties and still more powerful. It is a native of Surinam. Its appearance is very like that of the common quassia, but it seldom finds its way into this country.

Quassia is brought over in cylindrical billets, varying in diameter from two inches to a foot. It is covered with a smooth bark, slightly adherent, possessing the properties of the wood. In shops it is in the form of chips or rasped.

The wood is of a pale yellow colour, inodorous, but possessing a powerfully bitter taste, which is very permanent. It gives out its properties to water or alcohol; an extract has been obtained from it, for which Dr. Thomson proposed the name Quassin. This substance, embodying the properties of quassia, affords precipitates only with nitrate of silver and acetate of lead; hence it is compatible with any other medicines with which it may be thought desirable to combine it.

Medical Properties.—Quassia is an excellent tonic and may be considered as the most pure and simple of bitters. It is not a stimulant and is therefore useful in dyspepsia, where there is some irritability of the stomach, and also during the convalescence from fevers. It is likewise valuable as a menstruum for some of the salts of iron, especially the Tinctura ferri sesquichloridi. It might be given in all cases in which bitter tonics are indicated. It is said to be largely employed by brewers, to give bitterness to their beer.

It may be given in the form of infusion or tincture.

Dose.—Of the infusion, ℥j to ℥ij, three times a day.

Prep.—Inf. Quassiæ.

QUERCUS.

The bark of QUERCUS PEDUNCULATA. *Common Oak.*

The bark of this tree is officinal. It should be collected in the spring, and from branches of about three or four years old. It contains gallic acid, tannin, and extractive matter, on which its virtues mainly depend. The infusion of oak-bark is remarkable for not occasioning a precipitate with tartar emetic. This bark is extensively employed in the tanning of leather.

Medical Properties.—Tonic and astringent, but it is seldom prescribed for internal use. In intermittents, it has been combined with cinchona, when the latter passes off too rapidly by the bowels, and it might be given in diarrhœa and passive hæmorrhages. A decoction of it may be employed as a gargle for relaxed uvula. It is often employed externally, as an astringent in prolapsus ani and piles, condylomata, and used as an injection with alum in leucorrhœa.

Some have recommended a solution of it in the form of a bath for children, as a tonic to the body, when medicines could not conveniently be administered, It may be given in decoction, or an extract may be procured from it.

Dose.—If given in powder, ʒss to ʒj.
Of the decoction, ℥ij.
Of the extract, gr. x.

Prep.—Decoctum Quercus.

QUINÆ DISULPHAS. (*Vide* p. 34.)

RESINA.

The solid residue of the distillation of the TEREBINTHINA VULGARIS. *Common Rosin or Yellow Resin.*

This substance is only employed in the preparation of ointments and plasters. It is considered to be mildly stimulant.

Prep.—Ceratrum Resinæ,—Empl. Ceræ,—Empl. Resinæ,—Empl. Picis.

RHAMNUS.

The berries of the RHAMNUS CATHARTICUS. *Purging Buckthorn.*

This is a shrub growing about seven or eight feet high, common in hedges, and a native of Europe. It flowers in May and June. Its berries are ripe in September and October. The berries only are officinal. They are of the size of a pea, round, somewhat flattened at the top, black, smooth, shining, with four seeds, surrounded by a green, juicy parenchyma. Their odour is unpleasant, the taste rather bitter, acrid, and nauseous. The expressed juice soon ferments, generating acetic acid, which turns it of a red colour. Evaporated to dryness with some lime, it forms the pigment called *sap-green.*

Medical Properties.—Actively purgative, but the operation of them is attended with very severe griping, consequently aromatics should always be added. The only form in which this drug is usually employed is a syrup, which may sometimes be given to children, when there is difficulty in administering other purgatives. It is a useful adjunct to purgative draughts. Formerly it was considered a valuable hydragogue cathartic, and was given in dropsies, gout, and rheumatism. Buckthorn berries have a powerful purgative action on some animals, especially dogs.

Dose.—For a child, ʒj to ʒij of the syrup.
an adult, ℥ss to ℥j.

Prep.—Syr. Rhamni.

RHEUM.

The root of an uncertain species of RHEUM. *Rhubarb.*

The variety of Rhubarb from which the root is procured is not now designated by the London College, as it is supposed by many writers that it is the produce of several varieties, such as *R. undulatum*, *rhaponticum*, *compactum*, *emodi*, which has been named by Don and Colebrooke, Australe. From all that has been said and done on the subject, there is no conclusive evidence to show what species affords it, nor is there any reason for concluding that it is not obtained from two, three, or more species.

All the species are perennial and herbaceous, with large branching roots, sending up stems from six to eight feet high, with large petiolate leaves.

The *Rheum rhaponticum*, when cultivated, chiefly produces the stems and the leaf-stalks which are used as a substitute for gooseberries in making tarts and pies. Rhubarb is produced abundantly in the mountainous districts of Tartary, and in some of the Chinese provinces, from which parts our supplies of Russian and Chinese Rhubarb are derived.

The root is not considered good till the plant is six years old. It is dug up twice a year in Tartary, in spring and autumn; in China only in the winter. After it is taken from the ground it is deprived of its cortical covering, and separated into pieces of a convenient size. These pieces are then bored through, and suspended by strings upon cords, to dry in sheds. Several other processes are employed to reduce it to a proper condition for the markets, which are detailed in larger works on Materia Medica.

Chemical Properties.—Rhubarb yields its active properties to water and alcohol. The infusion is of a dark reddish yellow colour, possessing the odour and taste of rhubarb: the residue is whitish, inodorous, and insipid.

The virtues of the drug are somewhat impaired by boiling. Rhubarb, according to the analysis of M. Henry, affords—

A peculiar yellow colouring matter (Rhein, Rhabarbarin, or Chrysophanic acid); starch; gum; tannin; lignin; oxalate of lime; supermalate of lime; phosphate of lime; a salt of potash; oxide of iron; the latter four in small proportions.

The most interesting ingredient is the yellow colouring matter. It possesses the odour of rhubarb, has a bitter harsh taste, is slightly soluble in cold water, volatilizes in yellow vapours by heat, is reddened by solutions of potassa and ammonia, precipitated yellow by acids and most metallic salts, green by sulphate of iron, and converted into artificial tannin by nitric acid. This substance has been named *Rhabarbarin*, by some chemists, and by Caventon has been obtained in the form of crystals. Oxalate of lime gives the gritty feel to rhubarb, if it is chewed. It has been found to form, in some specimens, almost a fourth of the weight.

European rhubarb contains less oxalate of lime, but more tannin and fæcula.

The varieties of rhubarb yield different quantities of soluble matter to water and alcohol. The Chinese is said to yield 70 parts in 100 to water and alcohol; European, from *R. palmatum*, 64; *R. compactum*, 50 parts; *undulatum*, 32; *rhaponticum*, 30. Water, at 212, takes up 40 per cent. of Russian rhubarb; 50 of the Chinese. Alcohol dissolves 27 per cent. of the former; 40 of the latter.

The epithet Turkey, now incorrect, has been applied in consequence of rhubarb formerly being sent into this country from Turkish sea-ports. The so-named Turkish rhubarb should be called Russian, and is principally imported from St. Petersburg.

Medical Properties.—Rhubarb, in small doses, is tonic, stomachic, and astringent; in larger ones, purgative. As a purgative it principally acts on the muscular coat, producing rather solid evacuations. Its operation is liable to be followed by constipation. Hence in diarrhœas it is often administered first to clear out the primæ viæ; secondly, to restrain the evacuations, and give tone to the alimentary canal. To prevent subsequent constipation saline purgatives may be combined with it, and, if it occasions griping, aromatics may be employed. Rhubarb is very serviceable in dyspepsia; also in a disordered state of bowels of young children. When they are suffering from thrush, rhubarb with magnesia in small doses forms a useful combination.

It is well suited as a purgative for weak habits of body, but less so to persons suffering under fever or inflammations. In as short a time as ten or fifteen minutes a remarkable change is produced in the urine, which becomes of a deep red colour. This is owing to the absorption of the colouring principle of the rhubarb.

It may be administered in powder, extract, infusion, or tincture.

The *Dose* of the powder, gr. iij to gr. vj, as a tonic and astringent ; ℈j to ℥ss as a purgative.

Prep.—Inf. Rhei,—Pilula Rhei comp.,—Tinct. Rhei comp.,—Ext. Rhei.

RHÆAS.

The petals of the PAPAVER RHÆAS. *Common corn-poppy.*

This plant grows wild in every part of Europe, and is seen very abundant in our corn-fields. The capsule contains a milky juice, which, by drying, somewhat resembles opium ; but the small quantity procurable from each plant, and the trouble required for collecting it, more than compensates for any virtues it may possess. The part used officinally is the petals, on account of the beautiful colour which is extracted from them. Some chemists have discovered a very small quantity of morphia in them, but too small to make the drug of importance as a narcotic.

A syrup is prepared from them, much valued for its beauty of colour.

Prep.—Syr. Rhædos.

RICINI OLEUM.

The oil expressed from the seeds of RICINUS COMMUNIS. *Palma Christi, or Castor Oil Plant.*

This plant in the East Indies and Africa attains to the character of a tree, rising sometimes thirty or forty feet high. In more temperate latitudes it is an annual plant, flowering in May and June; its seeds ripening in August and September. This species of Ricinus is a native of the East Indies and Africa, but has been introduced into Europe. It is cultivated largely in the West Indies and many districts of the United States. The seed is the only part employed to produce the oil. In extracting the oil, care should be taken that the seeds are not rancid, which is very apt to be the case. In 100 parts of the seeds Geiger found, exclusive of moisture—

Envelope	23·82
Kernel	69·09

The kernel consists of—

Fixed oil	46·19
Gum	2·40
Starch and lignin	20·00
Albumen	0·50

The seeds themselves, taken internally, purge powerfully. Two or three are sufficient; but seven or eight act with great violence. Their acrid principle resides in the whole kernel, and not in the envelope, which is almost inert. This principle is volatile, and is dissipated by boiling in water. By a greater heat the oil is altered, and acquires acrid qualities. Castor oil is extracted by decoction, expression, and by the aid of alcohol.

In the East and West Indies the seeds are bruised after removing the husk, and then boiled in water. The oil which rises is skimmed off and again boiled, to remove the acrid principle. If the boiling be continued after the evaporation, the oil turns brown and acrid. This is observed more in the West Indian Oil. At the present time, little oil is imported from the West Indies, and by far the largest proportion from the United States.

The preparation of the oil by expression, ordered in the former, is discontinued in the last London Pharmacopœia.

The method of procuring it by alcohol has been practised in France, but the oil so obtained is said to become more readily rancid than that from other processes.

The seeds of the ricinus affords about 25 per cent. of oil. Castor oil is entirely soluble in pure alcohol, which circumstance would enable us to detect other fixed oils used to adulterate it, for they are in a very trifling degree soluble in that menstruum. The purgative qualities of this drug do not depend upon any one principle, but may be said to depend on the operation of its combined constituents.

Medical Properties.—Castor oil is an excellent purgative, acting, in most instances, mildly and speedily. In some persons it nauseates and distresses the stomach, and even sometimes plays the part of a drastic. It is intermediate in its action to saline and drastic cathartics. The chief objection to its use is the unpleasant sensation it gives to the fauces. It would be difficult to enumerate all the cases in which it might be advantageously prescribed. It is a good medicine for children, and is often given to women a day or two after parturition; and in inflammation of the bowels, or peritoneum, this is one of the first purgatives we prescribe. The best mode of taking it is, mixed with some warm milk. Some prefer it with a little peppermint water, gin, coffee, or tea.

Dose.—℥ss to ℥iss.

ROSA CANINA.

The pulp of the fruit of Rosa Canina. *Dog Rose* or *Wild Briar.*

This variety of rose is indigenous. The only officinal portion of it is the fruit, the soft pulpy substance of which is separated from the seeds by pressure.

The conserve made with it may be slightly laxative. It is employed in the form of linctus, with other substances in coughs, and used as a common vehicle in the preparation of pills.

Prep.—Conf. Rosæ Caninæ.

ROSA CENTIFOLIA.

This variety of rose is cultivated in our gardens, and is much admired in most countries. The petals are the officinal portion. They are fragrant, and have a sweetish, acidulous, somewhat bitter taste. The odour depends on a volatile oil, which may be obtained by distillation, and is known by the name of Otto of Roses. The quantity of oil, however, is very small, 100 pounds of the petals scarcely yielding half an ounce of it. It is chiefly prepared in the East Indies. It becomes concrete in cold weather, which, together with its odour, enables us to distinguish any adulteration with other volatile oils.

The petals are slightly laxative, and are used in making a syrup, which is more an elegant adjunct to draughts, than of service as a laxative. The petals are also employed to procure rose water.

Prep.—Aqua Rosæ,—Syr. Rosæ.

ROSA GALLICA.

The petals of this species are officinal. They should be gathered before the flower is blown, separated from their claws, and dried in a warm sun or by the fire, and kept in a dry place. Their odour is improved by drying. They contain, according to Cartier—

Tannin; gallic acid; colouring matter; volatile oil; fixed oil; albumen; salts of potash and lime; silica; oxide of iron.

The sensible properties and medical virtues are extracted by boiling water.

Red roses are astringent and slightly tonic, but chiefly used in infusion as a vehicle for other substances.

Prep.—Conf. Rosæ Gal.,—Mel Rosæ,—Infus. Rosæ Comp.

ROSMARINUS.

The tops of the ROSMARINUS OFFICINALIS. *Rosemary.*

This is an evergreen shrub, a native of the south of Europe, now cultivated and abundant in our gardens. The flowering summits are officinal. They have a strong balsamic odour, which, in a more feeble degree, exists in the other parts of the plant. The taste is bitter and camphorous. This depends on a volatile oil, which may be obtained by distillation. The virtues are partially dissipated by drying, and it becomes inodorous by long keeping.

Medical Properties.—Gently stimulant, and, according to some, emmenagogue; it is seldom used in this country, although it is an ingredient in many preparations on the Continent. It has been used as a sternutatory, and in some external applications.

Dose.—Of the oil, 5 to 10 drops.
Of the spirit, ʒj to ʒij.

Prep.—Ol. Rosmarini,—Spir. Rosmarini,—Lin. Saponis.

RUMEX.

The leaves of the Rumex Acetosa. *Common Sorrel.*

This plant is indigenous. Its leaves are pleasantly sour, and without odour. The sourness depends on the presence of binoxalate of potash, with a little tartaric acid. There is in them also some starch and mucilage. The taste is almost lost by drying.

Medical Properties.—Refrigerant and diuretic, and may be used as an article of diet in scorbutic complaints. The juice has been taken as an acidulous drink in fevers, in doses of ʒss to ℥j.

RUTA.

The leaves of Ruta Graveolens. *Common Rue.*

This plant is a native of the south of Europe, but now very common in our gardens; it flowers from June to September. The whole plant is active, but the leaves are commonly preferred. They have a strong odour, and a bitter, hot, and acrid taste. In the fresh state, they are sometimes capable of blistering the skin, if they are much handled: the virtues depend chiefly on a volatile oil, which is abundant, and is contained in glandular vesicles, dispersed over the whole surface of the plant.

Their active properties are extracted both by alcohol and water.

Medical Properties.—Stimulant and antispasmodic. It is used in hysteria, flatulent colic, and amenorrhœa, and worm cases. By the ancients, it was used as a condiment, and was supposed to be an antidote to poisons.

Dose.—Of the powdered leaves, gr. x to gr. xx.

Prep.—Conf. Rutæ.

SABADILLA.

The seeds of Asagræa Officinalis.

This plant, formerly named Veratrum Cevadilla, is a native of Mexico, bearing spiked racemes; the fruit is a capsule with three cells, each containing two or three seeds, which are blackish and angular. They have no odour, but an acrid and bitter taste. According to MM. Pelletier and Caventon, they contain—

Fatty matter; wax; acid gallate of veratria; gum; woody fibre.

These seeds are never given internally. They are employed for procuring veratria according to the process of the former London Pharmacopœia, which is as follows:

The sabadilla is to be boiled in spirit and pressed, and then the spirit is to be distilled off. The residue is to be treated with water and dilute sulphuric acid repeatedly, by which we get an impure sulphate of veratria in solution; this is to be evaporated and then mixed with magnesia, whereby we have formed a soluble sulphate of magnesia, and veratria is precipitated in an impure state. This is to be collected by filtration, and again dissolved in dilute sulphuric acid; now charcoal is added to decolorise the liquid, and, lastly, ammonia is added to precipitate the veratria in a pure state.

For its chemical qualities, *vide* VIRATRUM.

Medical Properties.—Irritant, anodyne, narcotic, and secondarily sedative and powerfully sternutatory. It is not a fit medicine for internal use. It is best employed as a topical application to allay pain in rheumatic or neuralgic affections, in the form of ointment (ʒss to ℥j) or in the shape of a tincture.

SABINA.

The tops of JUNIPERUS SABINA. *Savine.*

This is an evergreen shrub, very common at present in this country, somewhat resembling the juniper, but not generally attaining to so large a size. It is a native of the South of Europe and the Levant. The ends of the branches should be collected for medical use, in the spring. The tops and leaves have a strong, heavy, disagreeable odour, and a bitter acrid taste. These qualities depend on a volatile oil, which may be separated by distillation in the usual manner. It amounts to 15 or 16 per cent. They impart their properties to alcohol and water.

Medical Properties.—Savine is highly stimulant and diuretic, increasing also the secretion of the skin and uterus, on which it exerts a powerful action. It is used most commonly in amenorrhœa, and by some has been prescribed in chronic rheumatism. This drug has the character of being able to procure abortion, and deaths unfortunately have resulted from such an abuse of it. It is considered that abortion will not result from it unless such disturbance of the system has been occasioned as to endanger the life of the female.

Savine is used in the form of a cerate as an external irritant, to promote the discharge from blistered surfaces. It has been applied in powder, or in infusion to warty excrescences, indolent ulcers, psora, and tinea capitis.

Dose.—Of the powder, gr. v to gr. xv.
Of the oil, 2 to 5 drops.

Prep.—Unguentum Sabinæ.

SACCHARI FÆX.

Treacle.

This is the uncrystallizable syrup left after separating the crystallizable sugar. It is used in the Pharmacopœia, in the preparation of some pills. And is also an useful vehicle for some medicines for children, particularly the sesquioxide of iron.

SACCHARUM.

Sugar.

The prepared juice of the SACCHARUM OFFICINALE. *Sugar-cane.*

For an account of the process for procuring sugar, the reader is referred to numerous non-medical works.

SAGAPENUM.

A gum-resin, obtained from an unknown variety of FERULA.

It is collected in Persia, and is imported from Smyrna, Alexandria, and other parts of the Levant. In its external characters it somewhat resembles assafœtida, but is generally darker coloured, has a greasy appearance, is often mixed with impurities, has a strong alliaceous odour, and a hot, bitterish, nauseous taste. It is best dissolved by proof-spirit. According to Pelletier, its constituents are, in 100 parts—

Resin	54·26
Gum	31·94
Bassorin	1·0
Peculiar substances	0·60
Acidulous Malate of lime	0·40
Volatile oil, including loss	11·80

Brandes found 3·73 per cent. of volatile oil.

Medical Properties.—Stimulant, antispasmodic, and a reputed emmenagogue and anthelmintic. It partakes of the properties of assafœtida and galbanum. It is given chiefly in amenorrhœa, hysteria, and chlorosis.

Dose.—Gr. v to xx.

Prep.—Pil. Galb. comp.,—Conf. Rutæ.

SAGO.

A form of starch procured from the SAGUS LÆVIS, and other species of palms. *Sago Palm.*

This is one of the smallest of this family, seldom exceeding thirty feet in height. It grows plentifully in the East Indian Islands, especially the Moluccas, Borneo, and a part of New Guinea. The pith of the stem is the part which affords the Sago. As much as 500 or 600 pounds of it are said to have been obtained from one tree.

Sago is a mild nutritious substance, easily digested, well adapted for cases of fever, in which the stomach rejects more substantial or stimulating substances. It is given dissolved in water, and is rendered very grateful to the palate, by adding to it a little sugar, or some spice, or a small quantity of wine. A table-spoonful of sago to a pint of water is sufficient.

SAMBUCUS.

The flowers of SAMBUCUS NIGRA. *Common Elder.*

This variety of Sambucus may be called a small tree. It is indigenous, and flourishes in almost every part of this country. The flowers only are officinal. The berries, which are of a dark purple colour, are employed in making a species of wine.

The flowers have a peculiar, rather unpleasant odour, stronger when they are fresh than dried. Their taste is slightly bitter. They contain a volatile oil in small quantity, and ammonia is found in the water in which they may have been heated. The berries contain sugar, mucilage, and malic acid.

The inner bark is ordered in the Dublin Pharmacopœia.

Medical Properties.—The flowers are slightly excitant and diaphoretic, but very seldom used. They are more employed externally in ointments, fomentations, and poultices.

The berries are diaphoretic and aperient. Their inspissated juice has been administered in rheumatism, gout, cutaneous and syphilitic eruptions, in doses of ʒj to ʒij, as an alterative, ʒss as a laxative.

The inner bark is a hydragogue cathartic, and emetic in large doses. It has been given in dropsies and some chronic diseases; one ounce may be boiled with two pints of water down to one, and two to four ounces of it given for a dose.

Prep.—Ung. Sambuci,—Aqua Sambuci.

SAPO.

Hard soap is made by the action of soda on olive oil. According to the discoveries of chemists, the oil is decomposed, and gives rise to the production of two acids, margaric and oleic, with a third principle, named glycerine. These two acids unite with the soda to form soap. The variety of hard soap used medicinally is ordinarily called *Castile soap*. This is recognised by its marbled or mottled appearance, bluish in the centre, and red on the surface after it has been exposed to the air. This colouring is given by sulphate of iron, which at first makes the streaks of the interior blue, and the iron, by becoming exposed to the air, attracts more oxygen, and becomes a sesquioxide.

Sapo mollis, *soft soap*, is made with olive oil and potash. The oil used is generally of a very inferior quality. It contains usually a considerable excess of alkali, and hence is more powerful as a detergent.

Medical Properties.—Laxative, antacid, emetic, diuretic, externally emollient and detergent. It is given in dyspepsia with rhubarb, to relieve constipation, and to assist the hepatic system: also in urinary disorders, where the uric acid prevails. At one time it was considered antilithic, that is, that it prevented the formation of urinary calculi, and even had the power of dissolving them, when formed. Soap may be serviceable in cases of poisoning, as an emetic, when more powerful ones are not at hand. It should be given freely, dissolved in water. It is often used in pharmacy to give consistence to pills, and to prevent their becoming too hard and insoluble after long keeping. It likewise enters into several discutient applications.

SARZA.

The root of SMILAX OFFICINALIS. *Sarsaparilla.*

The plant which affords this was long named Smilax Sarsaparilla, till it was ascertained to be another species, which is now thought to be correctly designated. The plant is perennial, with an annual climbing or trailing stem, which is angular and prickly. It abounds about the river Magdalena, and is the Zarsaparilla of the natives. The plant also grows in Mexico, Guatemala, and the warm latitudes of South America. The root is very long and slender, and as it is brought into the market from various sources, is divided into several commercial varieties, such as Honduras, Jamaica, Lisbon, &c.

Honduras sarsaparilla comes in bundles two or three feet long, consisting of the roots folded lengthwise, and secured by some circular turns, and packed in bales weighing about 100 pounds, imperfectly covered with skins. The roots, at one extremity, are collected in large numbers to a common head, to which a portion of the stem is sometimes appended.

The *Jamaica* or *red sarsaparilla,* generally reputed to be the best, is not produced in Jamaica, and only got the name in consequence of that island being a channel for its exportation. Its chief source is Columbia. A large quantity of sarsaparilla is also shipped from Vera Cruz and Tampico. The bundles are rather smaller than of the Honduras variety, the fibres are smaller, and the bark is thinner.

The *Brazilian* or *Lisbon sarsaparilla* grows in the country between the Orinoco and Rio Negro, and is conveyed to the port of Para. It is distinguished by the amylaceous character of its interior structure, and on this account has at times been supposed to be the most valuable variety.

Dried sarsaparilla root is wrinkled externally, of a gray-brown, reddish, and sometimes blackish colour, composed of a thin epidermis, a thick cortical portion, ligneous fibre, and a central pith. In its ordinary state it is almost inodorous, but in decoction acquires a very peculiar odour. It is mucilaginous and slightly bitter to the taste, and, after long chewing, causes an acrid sensation in the fauces. The root is considered to be efficacious in proportion as it possesses this acrimony, which appears to reside chiefly in the cortical part. The virtues are imparted to water, but are impaired by long boiling. Diluted alcohol is considered to be even a better menstruum than water, for taking up the matter.

The chemical composition of sarsaparilla is very uncertain; and different chemists disagree much as to the proximate principles they find in it. It contains starch, lignin, and extractive matter. Canobio found 3 per cent. of resin; Berzelius found volatile oil; Palotta discovered a white powdery substance, which he named Pariglin, and thought it was the active principle: to a similar substance Folchi gave the name of Smilacin. Much of the uncertainty may have arisen from the sarsaparilla being liable to deterioration by keeping, and being collected from other varieties of smilax, which are less useful. If it does not produce an acrid sensation in the throat, after being long chewed, it should be rejected.

Medical Properties. — Sarsaparilla is generally considered to be alterative, diaphoretic, tonic, and antisyphilitic.

At one period this medicine was supposed to be a specific in the cure in syphilis; such an idea now is almost altogether abandoned. It may be and appears to be very serviceable in the management of the secondary forms in combination with other remedies, after a protracted use of mercury, and the system being greatly reduced. It is certainly useful in some skin diseases; possibly it does good by soothing the internal mucous membrane, by lubricating and allaying irritation, and may enter the circulation and attenuate and purify the blood. It is also prescribed in chronic rheumatism and scrofulous affections, and after protracted diseases, in which there is emaciation and a cachectic appearance, with any perceptible organic affection. If the compound decoction of sarsaparilla proves beneficial, it is not fair to give all the merit to the sarsaparilla, as there are other ingredients which are certainly quite as active.

Dose.—In powder, ʒss to ʒj, seldom taken on account of the bulk.

Of the decoction, or compound decoction, a pint may be given in the day.

Of the extract, ℈j to ʒj.

Prep.—Decoct. Sarzæ, — Dec. Sarzæ comp., — Extr. Sarzæ Fluidum,—Syrupus Sarzæ.

SASSAFRAS.

The root of SASSAFRAS OFFICINALE, *alias* LAURUS SASSAFRAS.

This tree is a native of the United States, Mexico, and Brazil, and is also found in Cochin-China. The parts of it used, are the wood, the pith, the root, and bark of the root. The root only is ordered in our Pharmacopœia. The most active part is the bark of the root.

The wood is porous, of a light brown colour, laminated, and covered with a spongy bark, which is divisible into layers. The bark is of a rusty colour, very brittle, of a lighter colour in the interior. Its odour is fragrant; the taste sweetish and aromatic. These qualities are extracted by water and alcohol; they reside in a volatile oil, which can be separated by distillation.

Medical Properties.—Sassafras is mildly stimulant, and sometimes diaphoretic. It is also called an alterative. It is most employed as an adjuvant on account of its pleasant flavour. It is recommended in secondary syphilis, chronic rheumatism, and skin diseases. It would be very wrong to place much reliance on it. In the London streets, especially in winter nights, an infusion of it is sold at stalls, known by the name of Saloop: its admirers consider it a most wholesome beverage. It may be given in infusion or decoction, *ad libitum*, or the oil may be given in doses of ten to twenty minims.

Prep.—Dec. Sarzæ comp.,—Ol. Sassafras.

SCAMMONIUM.

The Gum-resin of Convolvolus Scammonia.

The plant which affords scammony has a perennial root, with annual, trailing, twining, herbaceous stems. It is a native of Syria and the neighbouring countries. The drug is collected in the following manner: in the month of June the earth is cleared away from the root, which is sliced off about two inches from the top, and the milky juice which exudes is collected in shells or any other convenient receivers. A few drachms only are collected from each root. The juice from several plants is placed in a proper vessel and gradually hardens, forming pure scammony. It is not exported in this state, but is mixed with the expressed juice of the leaves and stalks, wheat-flour, chalk, fine sand, &c. The drug produced in Syria is called Aleppo scammony, and is the best. Another variety is named Smyrna scammony, from the place of its export. The precise source of it is not known.

Aleppo scammony is in large, irregular, heavy masses, generally somewhat porous, occasionally quite compact. The colour internally is lighter than on the outside, but becomes dark by exposure to the air. It is easily pulverized, and yields a light gray powder. Saturated with water, it gives a greenish milky appearance. The smell of it is likened to old cheese. The taste is bitterish, and slightly acrid.

Smyrna scammony is in flat cakes, darker, heavier, more compact, less easily pulverized, with a bitter acrid taste, and an odour different from the preceding variety. With water it forms an opaque solution of a dirty white colour.

Scammony is classed with gum-resins. It is partially soluble in water and alcohol, entirely in proof-spirit, excepting the impurities. Its chief constituent is resin, which forms, in the best specimens, about 80 per cent., but some of the inferior specimens do not contain more than 40 per cent. of resin.

Medical Properties.—Scammony is a drastic cathartic, and may also be called an anthelmintic. It acts with considerable violence in large doses, producing slimy mucous evacuations. As a purgative it is perhaps the best for discharging mucus; it not only discharges that already secreted, but stimulates the mucous follicles, unloading them, and thus removes the nidus of the worms of the intestines, by which proceeding they are more easily dislodged. This is probably the only explanation to be afforded of its anthelmintic virtues. Scammony is generally given in combination with other purgatives, and with aromatics, especially ginger, to counteract its griping effects.

Dose.—For an adult, gr. x to gr. xv.
a child, gr. iij to gr. v.

Prep.—Conf. Scamm.,—Pil. Col. c.,—Pulv. Scamm. comp.

SCILLA.

The fresh bulb of URGINEA SCILLA, *or* SCILLA MARITIMA. *Squill, Sea Onion.*

This plant is perennial, with fibrous roots proceeding from the base of a large bulb, which sends forth several large leaves, and a long succulent flower-stem supporting a long spike of whitish flowers. It grows on the sea-coast of Spain, Italy, Greece, and other countries bordering the Mediterranean. The bulb is the officinal portion, and may be kept for some months in a moist state by immersion in sand. It is pear-shaped, varying in size from that of a fist to a child's head, consisting of fleshy scales, thin at their margin, and thin and dry externally, so as to appear like a membranous envelope. The colour of the interior is ordinarily white; sometimes it has a pinkish tinge. The bulb abounds in an acrid juice, which will inflame the skin and even excoriate it, if much handled. By drying, the acrimony is diminished, without lessening the medical virtues, and four fifths of the weight are lost. The drug is usually kept in the form of thin dry slices, prepared by incision and artificial heat; the most external and internal parts are rejected; the former wanting the active principle, and the latter being too fleshy and mucilaginous. Squill may be pulverized, but it is difficult to preserve it in that state long, on account of its absorbing moisture from the air, which makes it concrete it into a mass. The odour is feeble, the taste bitter, nauseous, and acrid. The virtues of squill are extracted by water, alcohol, and vinegar. The constituents, according to Vogel, are—

A bitter principle, named *scillitin;* gum; tannin; traces of citrate of lime, and saccharine matter; an acrid principle, which he could not isolate.

The tannin is in very small quantity. The scillitin is soluble in water, alcohol, and vinegar. According to another chemist, the acrid principle is insoluble in water and dilute acids, but soluble in strong alcohol. From the conflicting statements it is clear that little is known for certain respecting it; acicular crystals (named raphides) are found in the scales, and amount sometimes to 10 per cent. of their weight, they are supposed to consist either of phosphate or oxalate of lime.

Medical Properties.—Squill is a stimulating expectorant, diuretic, and in large doses emetic and purgative. As an expectorant it is only suited for chronic diseases, such as chronic catarrh, asthma, and bronchitis, occurring in elderly people. It acts by giving tone to the vessels of the mucous membrane, and causing them to throw out more healthy fluids. When there is deficient secretion, it is better to be combined with tartarized antimony, or ipecacuanha. When there is excessive secretion, with debility, it diminishes the quantity, by giving tone to the relaxed vessels.

Squill is an improper medicine for children's diseases generally; we have a much better substitute in ipecacuanha. As a diuretic, squill is much used in dropsies, and is very often combined with calomel or Pilula hydrargyri, which assists, by exciting the absorbents to take up the squill, that it may stimulate the kidneys to increased secretion. As an emetic and purgative it is better left alone, for in overdoses it causes hypercatharsis, strangury, bloody urine, bloody stools, and fatal inflammation of the stomach and bowels.

Dose.—Of the powder, one grain, gradually increased to five.
Of the tincture, ʒss to ʒj, ter die.
vinegar, ʒss to ʒjss.

As an emetic, the quantity which has been given is eight to twelve grains. In the moist state squill is not administered; but its strength, compared with the dried substance, is only one fifth.

Prep. — Acetum Scillæ,—Oxymel Scillæ, — Pil. Scillæ comp.,—Tinct. Scillæ.

SCOPARIUS.

The tops of CYTISUS SCOPARIUS. *Common Broom.*

This shrub is indigenous, existing in great abundance on our heaths; readily recognised by its beautiful yellow flowers. The whole plant has a bitter nauseous taste, and when bruised, a strong peculiar odour. The tops are officinal, but the seeds possess similar properties. The virtues are extracted by water and alcohol.

Medical Properties.—Diuretic and cathartic. It has been prescribed in dropsies, sometimes with great relief. It is best given in the form of decoction, for the preparation of which a formula is now given in the London Pharmacopœia.

Dose.—Of the docoction, one to two ounces three times a day.

Prep.—Dec. Scoparii comp.

SENEGA.

The root of POLYGALA SENEGA. *Rattlesnake Root.*

This plant grows wild in most parts of the United States; the root is perennial, but the stem annual; of rather a diminutive size, seldom growing more than nine inches high. The root only is used officinally. This root, at first sight, bears some resemblance to ipecacuanha, in its small branches, but is readily distinguished by the tuberosity on its summit, from which several stems had grown. The outer part is hard and resinous, and contains the active principle; the internal portion is comparatively inert. The taste of the root is at first sweetish and mucilaginous, and after chewing, pungent and acrid, leaving great irritation in the fauces. The active principles are extracted by boiling water, also by alcohol, in rather a less degree; diluted alcohol is the best solvent. According to the analysis of Gehlen, it contains—

Senegin	6·15
Soft resin	7·5
Acrid extractive matter	26·85
Gum, with a little albumen	9·5
Lignin	46·

Medical Properties.—Senega is a stimulating expectorant, tonic, and at the same time somewhat diaphoretic. It is said also to be emetic, purgative, and emmenagogue, in fact increasing most of the secretions. Its good effects are best shown upon the pulmonary organs, for, at the same time that it restores the tone of the mucous membrane of the air-tubes, it is a tonic to the system generally. It combines the good effects of ipecacuanha with those of the vegetable tonics. I have used it with much benefit in chronic catarrhs, in the last stages of bronchitis or pneumonia, where there is excessive secretion, and at the same time much debility; and I believe that it is little used because many who have prescribed it have given it in improper doses. By some it has been much extolled as an emmenagogue.

Dose.—In powder, gr. v to gr. x.
Of the decoction, ʒvj to ℥j.
Prep.—Decoctum Senegæ.

SENNA ALEXANDRINA.

SENNA INDICA.

Alexandrian Senna, according to the present London Pharmacopœia, is the leaf of the Cassia Officinalis and Cassia Obovata. The East Indian Senna is the leaf of the Cassia Officinalis.

The drug named Senna is considered to be the produce of several species of Cassia, and of other plants besides. Those which contribute most to its formation are the *C. acutifolia*, *C. obovata*, *C. elongata*, and *C. lanceolata*.

The *Cassia acutifolia* is a small shrub growing from two to three feet high, abundantly in Upper Egypt, near Sienna, in Nubia, and Sennaar. It furnishes the Tripoli Senna, and forms the greater part of Alexandrian Senna. The leaflets are ovato-lanceolate, acute, oblique at their base, nerved, from half an inch to an inch in length, and of a yellowish-green colour.

The *Cassia obovata* is a still smaller shrub, rarely growing more than a foot high. The leaflets are obovate, very obtuse, sometimes mucronate. It grows wild in Syria, Egypt, and Senegal, and has been cultivated in Spain and Italy. It yields the variety of Senna named Europe-Aleppo Senna, and enters into the composition of the Alexandrian.

Cassia elongata is the name conferred on the plant from which the East Indian Senna is derived. It has not been described as having been seen growing by naturalists. The leaflets are elongated, acute, thin, obscurely mucronate, oblique, with very short petioles. The length is remarkable, compared with the other sennas: it varies from an inch to 20 lines; the breadth is from 3 to 5 lines.

The *Cassia lanceolata* is mentioned by some authors, and has been described as growing in Arabia and the East Indies. Decandolle considers it to be a variety of the *C. acutifolia.*

In addition to the plants just mentioned, we find mixed with the senna, leaves of other plants, such as *Cynanchum oleafolium* known also by the name of *argel*, the *Colutea arborescens*, and *Coriaria myrtifolia*. The Cynanchum oleafolium is found in the Alexandrian Senna, and may be distinguished by a careful inspection of the leaves. They are generally an inch long, thick and firm, have no lateral nerves on their under surface, of a somewhat lighter colour, and have a regular base. It is remarkable in the real senna leaves, that whatever be the species, they are always characterised by obliquity at their base, one side of the limbus being inserted into the petiole lower down than the other, and forming a different angle. For medical use, senna is prepared by picking out the leaflets and rejecting the leaf-stalks, the small fragments, and leaves of other plants ; the pods are also rejected, although unnecessarily, as it appears that their purgative qualities are equal to those of the leaves.

Properties.—The odour is faint and sickly. The taste is slightly bitter, sweetish, and nauseous. Water and alcohol extract the active principles. To water senna-leaves yield one third of their weight. The infusion exposed to the air for a short time deposits a yellowish insoluble precipitate, supposed to arise from the union of oxygen with the extractive matter. Decoction impairs the medical virtues considerably. By analysis, MM. Lassaigne and Feneuille discovered—

A peculiar principle, named cathartin; chlorophylle; a fixed oil; a small quantity of volatile oil; albumen; yellow colouring matter; mucilage; malate and tartrate of lime and acetate of potash; mineral salts.

The active purging principle is considered to be the cathartin. It is an uncrystallizable substance, having a peculiar smell, a bitter nauseous taste, and a reddish-yellow colour; is soluble in water and alcohol, but insoluble in ether; and in its dry state attracts moisture from the atmosphere. It is thus prepared: to a decoction of senna add acetate of lead, and then remove the liquid from the precipitate. Through the solution pass hydrosulphuric acid, to precipitate the lead, and separate the sulphuret by filtration. The liquid is now evaporated to the consistence of an extract, and the product is treated with rectified alcohol, and the alcoholic solution is evaporated. This is further purified by repeated washing, and the liquid, by evaporation, yields cathartin.

Medical Properties.—Senna is a prompt and efficient purgative, very useful where a decidedly violent impression is not required. The chief objection to its use is the severe griping which attends its operation. This, however, may be obviated in a great measure by combining with it either aromatics, or neutral salts, or camphor. The aromatic spirit of ammonia is a pleasant addition, and does not appear to diminish its efficacy. The operation is said to be promoted by giving it in combination with bitters, a fact noticed by several writers. Dr. Thomson considers that if the infusion be made with water several degrees below the boiling point, the purgative matter is dissolved, but the griping principle is either not dissolved or not developed. Such an infusion may not gripe so much, but certainly it is far less active than that made in the usual manner.

Senna might be given in powder, if its bulk did not make it inconvenient; it is most used in the forms of infusion and tincture.

Dose.—Of the powder, ʒss to ʒj.
infusion, ℥ij to ℥iij.
tincture, ʒij to ʒiv.

Prep.—Conf. Sennæ,—Inf. Sennæ comp.,—Tinct. Sennæ comp.

SERPENTARIA.

The root of Aristolochia Serpentaria. *Virginian Snake-root.*

Several varieties of Aristolochia have been in medical use, and, from supposition of their emmenagogue qualities, received their Latin name. The present variety is herbaceous, with a perennial root, consisting of numerous fibres, proceeding from a short caudex. The root only is officinal. It is a native of the United States.

This root has a yellowish-brown colour, bearing some resemblance to Valerian, from which it may be distinguished by the fibres being longer, smaller, and in greater number to each caudex. The smell is strong, aromatic, and camphorous; the taste is warm, bitter and camphorous. It yields its virtues to water and alcohol. Chevallier found in the root—

Volatile oil; a yellow bitter principle, soluble in water and alcohol; resin; gum; starch; albumen; lignin and various salts.

The active principles appear to be the volatile oil and the bitter principle, analogous to the quassin of quassia. The volatile oil will pass over by distillation with water. It is stated that this liquid, by standing, will deposit minute crystals of camphor.

Medical Properties.—Serpentary is a stimulating tonic, also somewhat diaphoretic and diuretic. If taken in excess it causes nausea, vomiting, and dysenteric tenesmus. It is best adapted for the treatment of typhus, when the system requires moderate stimulation: also in the exanthematous fevers, where there appears to be insufficient power to determine the eruption to the surface. It has also been recommended in intermittent fevers: and if not in itself sufficient to cure the disease, is a useful auxiliary to cinchona.

Dose.—Of the powdered root, gr. x to gr. xxx.
infusion, ℥iss to ℥ij, ter die.

Prep.—Infusum Serpentariæ,—Tinct. Cinch. comp.,—Tinct. Serpentariæ.

SEVUM.

Suet, fat from the Ovis Aries. *Sheep.*

This is the fat of the sheep, taken chiefly from about the kidneys. It is of a firm consistence, and requires a higher temperature for melting than any other animal fat. It contains a very large proportion of stearine, the solid principle existing in fat and oils. By long keeping suet acquires an unpleasant smell, and becomes unfit for pharmaceutical purposes. It is chiefly employed to give consistence to ointments and plasters.

Prep.—Emplastrum Ceræ.

SIMARUBA.

The bark of the root of Quassia Simaruba, or Simaruba Officinalis. *Mountain Damson.*

This tree is of considerable size. It grows in the West Indies and Guiana, and is named in Jamaica the mountain damson. The bark of the root is officinal; the wood itself being almost tasteless and inert. This bark has no odour, but a bitter taste; it imparts its virtues to water and alcohol. It is composed, according to Morin, of a bitter principle, supposed to be—

Quassin; resinous matter; volatile oil; malic acid; a trace of gallic acid; an ammoniacal salt; malate and oxalate of lime; some mineral salts; oxide of iron; silica; ulmin; lignin.

Medical Properties.—It is a mild tonic, possibly useful in cases in which similar remedies are indicated; but there is very little to recommend it It cannot be pulverized without much trouble.

Dose.—℈j to ʒj of the powder.
℥j to ℥ij of the infusion.

Prep.—Inf. Simarubæ.

SINAPIS.

The seeds of Sinapis Nigra and S. Alba. *Common Black and White Mustard.*

This plant is a native of the south of Europe, and now naturalised in this country, in which it grows very readily; the officinal part of the plant is the seed. The white mustard seed is also employed in most countries. The seeds of either plant yield a yellow powder, which has a somewhat unctuous appearance, and cakes when pressed; when bruised they impart their active qualities entirely to water, and in a less degree to alcohol. They yield by pressure a fixed oil of a greenish-yellow colour, with little smell or taste, the remaining portion being exceedingly pungent. By distillation in water, black mustard seeds yield a volatile oil, soluble in alcohol and water, of a powerfully pungent odour and acrid burning taste, containing a little sulphur, and capable of soon exciting vesication, when applied to the skin. This oil does not appear to exist ready formed in the seeds, but is an educt of the action of water. Messrs. Robiquet and Boutron could not obtain volatile oil from the white mustard seed. Their active qualities depend on a fixed principle not existing in the seed, but developed, like the volatile oil in the former case, by the action of water or other agents. The ingredient converted into the acrid principle is named *sulpho-sinapisin*, discovered by MM. Henry and Garot in the oil of white mustard, afterwards found in the seeds themselves. They believe this because mustard deprived of this substance is incapable of developing the acrid principle.

The two varieties differ essentially in their constitution, though it is likely that their characteristic ingredients are very analogous, as they both contain sulphur.

Sulpho-sinapisin is composed of sulphur, carbon, oxygen, hydrogen, and nitrogen. It is neither acid nor alkaline, white, crystallizable, soluble in water and alcohol, affording a yellow solution, inodorous, with a taste like mustard. It appears that vinegar diminishes the irritating properties of black mustard, and that the powder of it with strong acetic acid is almost inert upon the skin, although either separately is very irritating. This is not the case with white mustard.

Medical Properties.—Mustard seeds swallowed without bruising act as a laxative, and have been considered useful in dyspepsia, where there is a torpid state of the bowels; with this intention the white mustard is preferred, and is administered in the dose of a table-spoonful: their action is chiefly mechanical. The principal application of mustard in medicine is, as an external agent, to produce irritation, inflammation, and even vesication upon the surface. The poultice made with mustard is called a sinapism.

Mustard poultice, or a sinapism, is used as a rubefacient, counter-irritant, and stimulating application.

It is often prescribed as a substitute for cantharides, in consequence of a more certain and speedy operation. Great care, however, is necessary in the employment of sinapisms. If they are applied to an emaciated, delicate, and weakly body, and left on too long, they may occasion sloughing; in children they act sufficiently in the course of ten or fifteen minutes, and should be carefully watched, so that, as soon as the skin is reddened, they may be removed. They are much used in apoplexy, applied to the extremities. If put on the dorsum of the foot, calves of the legs, or thighs, from twenty to thirty minutes may be sufficient time to leave them on. When in contact with the soles of the feet, a longer time is necessary to produce any effect, in consequence of the thickness of the epidermis.

Sinapisms are beneficial by drawing blood to the surface, and, consequently, diverting its current from an internal organ. In apoplexy they cause a greater flow of blood to the extremities, relieving the upper part of the body; they may, at the same time, rouse into action the nervous system, depressed by an accumulation of blood in the head; and may in some cases be considered to act as evacuants.

Prep.—Cataplasma Sinapis.

SODÆ CARBONAS IMPURA.

Impure Carbonate of Soda, formerly the Sub-carbonate.

Soda is found mineralized in some countries, in others it is obtained artificially. Native soda is found in Egypt, and several other parts of Africa. It is obtained from lakes, which, by the evaporation of the water, produce the soda in a solid form. It is known by the name of Trona amongst the natives of Africa.

Soda of vegetable origin is procured from plants which grow on the borders of the sea, and is known by the name of Kelp and Barilla. Barilla is obtained from plants belonging to the genera Salicornia and Salsola; the species preferred are the *Salsola soda* and the *Salicornia herbacea*. In Spain, Sicily, and some other countries, the plant is regularly cultivated for the production of soda. The plants, when mature, are gathered, dried, and burnt in pits, about three feet deep and four broad, and the combustion is kept up till the pit is filled with the ashes. These are in the form of a hard, semifused, compact, saline mass, which, by pickaxes, is broken into fragments and sent into the markets.

Kelp is also procured from the incineration of seaweeds, principally the Algæ and Fuci, in the Orkney Islands, Wales, Scotland, and Ireland. The plants are allowed to ferment in heaps, then dried, and afterwards burnt to ashes in ovens, rudely built in the ground. The alkali, in the ashes, melts and forms the whole into a hard solid mass, which is broken up into smaller pieces and thrown into commerce.

Barilla contains from 20 to 40 per cent. of carbonated soda, the rest being sulphate of soda, sulphuret of sodium, common salt, carbonate of lime, alumina, silica, oxide of iron, and a small quantity of charcoal.

Kelp is less pure than barilla, containing only from 3 to 8 per cent. of carbonated soda, the rest being made up of a large proportion of sulphates of soda and potash, the chlorides of sodium and potassium, and a small quantity of either the iodide of sodium or potassium; it is from this that iodine is chiefly procured.

The soda of commerce, so extensively used in washing and a variety of other processes, is obtained artificially by decomposing the sulphate of soda and common salt. This is practised on a very large scale in Scotland. The impure carbonate is used in pharmacy to obtain the pure carbonate of soda.

SODÆ PHOSPHAS.

The salt is procured by adding to calcined bones some sulphuric acid with water, by which we have formed a superphosphate of lime in solution with a little sulphate, and sulphate of lime largely precipitated. The solution is removed and evaporated, that the remaining sulphate of lime may fall, by being deprived of the necessary quantity of water for its solution. The superphosphate is then treated with more water, and carbonate of soda is added till effervescence ceases: in this case part of the phosphoric acid combines with the soda, forming a soluble phosphate of soda, expelling carbonic acid, and subphosphate of lime is precipitated. By evaporating the liquid, the phosphate of soda is procured in crystals.

Composition:

1 phosphoric acid	=	72
2 soda	2 × 32 =	64
1 basic water	=	9
24 water of crystallization	24 × 9 =	216
		361

Medical Properties.—This salt is a mild purgative, and, as it has very little taste, will often suit delicate stomachs, and is well adapted for children. It requires to be given in rather large doses, and is best administered in gruel or weak broth, to which it gives a flavour, as if seasoned with salt.

Dose.—For an adult, from ʒss to ℥iss.

SODÆ POTASSIO-TARTRAS.

This salt, commonly known as Rochelle Salt, is obtained by boiling in water bitartrate of potash with carbonate of soda. In this case the excess of acid of the bitartrate combines with the soda of the carbonate, expelling carbonic acid, and a neutral bibasic salt is formed, and by evaporation is obtained in crystals.

Composition:

1 tartrate of potash	=	114
1 tartrate of soda	=	98
8 water	9 × 8 =	72
		284

Or it may be thus represented:

$$KO, NaO, C^8 H^4 O^{10} + 8 HO.$$

Medical Uses.—It is a cooling saline purgative, most agreeably taken in the form of Seidlitz powder.

Dose.—ʒij to ʒvj.

SODÆ SULPHAS.

This salt may be made from the following *ingredients:*

The salt which remains after the distillation of hydrochloric acid,
Carbonate of soda,
Boiling water.

Decomposition.—Any excess of acid remaining with the sulphate is saturated by the soda of the carbonate; carbonic acid is evolved, and the neutral sulphate is procured in crystals by evaporation.

Composition:

1 sulphuric acid		= 40
1 soda		= 32
10 water	10 × 9	= 90
		162

Formula $NaO, SO^3 + 10 HO$.

Qualities.—It effloresces by exposure to air. It is entirely soluble in water, not at all in alcohol. It has no action on litmus or turmeric. Nitrate of silver causes scarcely any precipitate in a dilute solution of it; nitrate of baryta, a very copious one of sulphate of baryta, which is insoluble in nitric acid. By heat, 55 parts per cent. are lost, being the water.

Medical Uses.—A mild, cooling purgative, less offensive to the taste than sulphate of magnesia.

Dose.—℥ss to ℥j.

SODII CHLORIDUM.

Common Salt.—This mineral substance is diffused over almost all parts of the world, and is found either crystallized or in solution in springs, and largely in the waters of the ocean. In the solid state, called rock-salt, it is found in extensive beds, occurring almost constantly in secondary formations, associated with clay and gypsum. The chief salt-mines are in Poland, Hungary, and Russia; in some parts of Germany; in our own country in Cheshire; in Spain, and various parts of Asia and Africa. Rock-salt is always transparent, but often exhibits various colours, as red, yellow, brown, violet, or blue; supposed to be derived from iron and manganese.

When the salt is pure, it is merely dug out of the mines; when impure, it is dissolved in water, and afterwards extracted from the solution by evaporation. From the saline springs, it is procured only by evaporation. Sea-water affords salt by the agency of solar heat in hot countries; and the salt, thus obtained, is called bay-salt. In Europe it is chiefly so prepared, especially on the shores of the Mediterranean. This is accomplished by letting in the sea-water into shallow dykes, lined with clay, and from which the sea can again be shut out. In these situations the sun's heat concentrates the water, and the salt crystallizes. In temperate climates, the water is first concentrated in buildings, called graduation-houses, which are of considerable length and height; in which are suspended faggots, upon which the brine is pumped. By the large surface exposed, evaporation is facilitated, and the brine acquires a considerable degree of concentration. It is then subsequently heated in iron boilers by artificial heat. Sometimes to save fuel, the last concentration is effected by allowing the brine to trickle down a number of vertical ropes, on the surface of which the salt is deposited, forming a crust. Chloride of sodium crystallizes in cubes; and, by hasty evaporation, it often assumes the form of hollow quadrangular pyramids. When pure, it undergoes no change in the air; when it becomes moist it is generally caused by the presence of muriate of magnesia.

It is composed of

1 chlorine = 36
1 sodium = 24
—
60

and has no water of crystallization, although a little water is generally present between its particles. In the salt of commerce impurities are found not very abundant, and can be removed by chemical processes, when we desire the salt to be quite pure; they are, in addition to the chloride of magnesium, chloride of calcium and sulphate of lime and magnesia, and some insoluble matter.

Medical Uses.—This salt is tonic in small doses; in larger ones emetic and purgative. It is considered to promote digestion, which is found to be less perfect if those accustomed to it are deprived of its use. It is used externally as a stimulant, either in fomentations or as a bath; as a tonic and excitant in depraved conditions of the system, especially in children, particularly depending on a scrofulous diathesis; and it is often employed in solution, as a stimulating enema.

It may be called also a vermifuge, as we find that it assists materially in the removal of worms, if used freely in the diet. This possibly may be owing to the tonic effect of salt on the stomach and bowels, and also the secretion of the liver. It is an interesting fact, that persons deprived of salt are almost certain of being subject to worms, and that when this salt is employed freely there is an exemption from them. The conclusion from this is obvious. As an emetic, salt is prompt in its operation, and during the cholera has been by some preferred to other emetics. Lately it has been given in typhoid fevers with chlorate of potash and sesquicarbonate of soda, and is thought to be beneficial by getting into the blood, and giving it that appearance and quality which it appeared to have lost from a deficiency of saline matter.

The use of salt is well known in domestic economy, as a condiment and antiseptic. It is employed in agriculture as a manure, and largely in the arts for several purposes. In pharmacy we employ it in preparing hydrochloric acid, chlorine, calomel, and corrosive sublimate.

Dose.—As a tonic, ℈j to ʒj.
As an emetic, ℥ss to ℥j.

SPIRITUS RECTIFICATUS.
Rectified Spirit.

SPIRITUS TENUIOR.
Proof Spirit.

These liquids are both composed of the same constituents, viz., alcohol and water, only differing in the relative proportions.

Alcohol, in a chemical point of view, is a compound of olefiant gas and water, or a hydrated oxide of ethule, consisting of $C^4 H^6 O^2$, and also the product of the vinous fermentation. It is generated in vegetable solutions by the process just mentioned; and the liquids containing it are called vinous or alcoholic; sugar appears to be necessary for its development, or starch, which is convertible into sugar; and, to assist it, moisture, a certain temperature, and a ferment are necessary.

When sugar is exposed to this process, it gradually disappears, carbonic acid flies off, and alcohol is found in the liquid; and it is also known that the weight of the carbonic acid, alcohol, and water is equal to the sugar which has disappeared; hence the conclusion is that by the vinous fermentation sugar is converted into alcohol, carbonic acid, and water. From all liquids thus fermented alcohol may be procured by distillation. In vinous liquors it is diluted with an abundance of water, and associated with colouring matter, volatile oil, extractive, and various acids and salts. In purifying it, advantage is taken of its volatility, which enables us to get it gradually more free from water. The distilled product of vinous liquors constitutes the various ardent spirits so extensively in use. From wine we obtain brandy; from fermented molasses, rum; from malted barley or rye, whiskey; from malted barley, or rye-meal, rectified from juniper, Hollands; from malted barley, rye, or potatoes, rectified with turpentine, common gin; and from rice, arrac. They are severally distinguished by their flavour, and their strength is known by their specific gravity, which is always inversely to their concentration. When the specific gravity is ·920, they have a strength equal to what we call proof spirit; and if stronger or weaker, they are said to be above proof or under proof. Proof spirit in this state is far from pure: it contains half its weight of water, essential oil, and foreign matters. It is further purified by distillation and rectification, as it is called. By repeating the process several times, the liquid can be obtained of a specific gravity ·825. It still contains 11 per cent. of water.

When it is desired to procure or obtain alcohol still more concentrated, substances are resorted to which have a strong attraction for water, such as chloride of calcium, lime, and carbonate of potash. These are heated and deprived of any moisture, and then put into the spirit. They attract and retain the water, whilst the spirit may be distilled over, of a lighter specific gravity: and by frequently repeating the operation, the water may be entirely removed, leaving absolute alcohol of specific gravity ·796.

Very useful tables have been constructed by chemists to show the proportion of water contained in spirit of different specific gravities, in the following manner:

100 PARTS.		Sp. gr. at 60.
Alcohol.	*Water.*	
100	0	796
93	7	815
84	16	838
49	51	920

Medical Properties.—Alcohol, in any of its forms, is a powerful stimulant, and to it we usually refer, in defining the effects of stimulants on the body. It produces a feeling of warmth in the stomach, which soon diffuses itself over the system; the heart beats stronger, the pulse is quicker and fuller, the secretions are increased, and also the appetite; there appears to be greater muscular energy, and excitement of the cerebral functions. These are the effects of a stimulant in moderation; if exceeded they pass into a state resembling narcotism, and are succeeded by considerable prostration. In its pure state, alcohol is not used medicinally, but is employed in the form of wine or brandy, named, in the Pharmacopœia, Spiritus Vini Gallici. This is found a valuable remedy in some severe diseases attended with extreme debility, as in some typhoid fevers and diseases of the nervous system occurring in persons long habituated to the use of ardent spirits. The use of ardent spirits is sadly abused by almost all classes of people. An excess of them lays the foundation of many diseases, such as dyspepsia, hypochondriasis, visceral obstructions, dropsy, paralysis, and sometimes mania.

If taken in an unusually large quantity, alcohol produces an apoplectic state, and sometimes sudden death. The face becomes livid, the lips purple, the respiration stertorous, the mouth frothy, and the sensation and feeling are more or less suspended. The remedies for this state are emetics, affusion of cold water, bloodletting, a small quantity of spiritus ammoniæ, or a large dose of liquor ammoniæ acetatis.

Alcohol, more or less diluted, is extensively used in pharmacy in the formation of tinctures, spirits, ethers, and resinous extracts, added to distilled water and some other liquids, to assist in their preservation ; and in consequence of its powerful antiseptic qualities, it is useful in preserving anatomical preparations.

STANNUM.

Tin.

Tin is one of the metals which has been longest known. It generally is found in the state of an oxide, very rarely as a sulphuret. It occurs in Cornwall most abundantly, and in some other countries of Europe. In Asia it is found in the island of Banca, and the peninsula of Malacca. In America, we find it in Chili and Mexico. The purest tin is procured from the mines in Asia.

This metal is occasionally employed medicinally in a metallic state, minutely divided. It is prepared by melting it, and, during the cooling, stirring it briskly, by which it is separated into small particles. They may then be sifted, to obtain them sufficiently fine.

Uses.—Tin is only employed as an anthelmintic, especially in cases of lumbricus teres. Its action is purely mechanical. It may be given in doses of one to two drachms twice a day, and a brisk purgative should be administered every third or fourth day. It has also been given for tape-worm in still larger doses, such as half an ounce to an ounce. The use of it has not been observed to be followed by any bad consequences.

STAPHYSAGRIA.

The seeds of Delphinium Staphysagria. *Stavesacre.*

This plant is a native of the south of Europe: the seeds of it only are officinal. They are irregularly triangular, wrinkled, brown externally, internally whitish and oily. They have little odour, but a very acrid, bitter, hot, nauseous taste. They yield their virtues to water and alcohol. According to the analysis of Lassaigne and Feneuille, they yield—

A brown and yellow bitter principle; volatile oil; fixed oil; albumen; an azotized substance; mucilaginous saccharine matter; mineral salts; delphine, an alkaloid, combined with malic acid.

Delphia, or *Delphine*, is a white substance, soluble in alcohol and ether, sparingly in water, and possessing a very acrid taste. It forms salts with acids. It is procured by boiling the seeds, and adding magnesia, by which the alkaloid is precipitated. This is to be taken up by alcohol, which yields it by evaporation or distillation.

Medical Properties.—Emetic and cathartic, but too violent for common purposes. They are chiefly used to destroy lice about the body, as in the hair or about the pubes. The powdered seeds, for this purpose, may be mixed with lard, and thus applied, or the powder sprinkled upon the parts. They have also been infused in vinegar, for the same purpose. They intoxicate fish, like Cocculus indicus. Delphinia is poisonous in small doses, acting powerfully on the nervous system.

STRAMONII FOLIA ET SEMINIS.

The leaves and seeds of Datura Stramonium. *Thorn-apple, Jamestown weed.*

This plant is an annual, generally considered to be a native of North America, being particularly common about Jamestown, whence it has obtained one of its English names. It grows freely now in this country, and when it has once been planted and the seeds allowed to ripen, the plant is almost sure of showing itself next season in or about our gardens. A large number of these plants growing together, produce a rank unpleasant odour, which may be detected at some distance. Every part of the plant possesses medical virtues. The leaves and seeds only are, however, officinal. The leaves, when fresh and bruised, exhale a fetid narcotic odour, which they lose by drying. Their taste is bitter and nauseous. They yield their properties to alcohol and water. According to Promnitz, they contain, in 100 parts—

Gum	0·58
Extractive	0·60
Green starch	0·64
Albumen	0·15
Resin	0·12
Saline matter	0·23
Lignin	5·15
Water	91·25

The seeds are small, somewhat kidney-shaped, almost of a black colour, inodorous, with a taste like the leaves, and some acrimony. Brandes examined them carefully, and detected, in addition to a peculiar alkaline principle which is named Daturine—

Glutinous matter; albumen; gum; a butyraceous substance; green wax; resin, insoluble in ether; fixed oil; bassorin; sugar; gummy extractive; orange-coloured extractive; some salts; an earthy substance.

Daturia is considered to be an alkaloid, soluble in like manner as the other alkaloids, and combined naturally with some malic acid. It is crystallizable in acicular prisms, and forms crystalline salts with nitric, muriatic, and sulphuric acids. It is procured by boiling the seeds in alcohol, then adding magnesia to the strained solution. The magnesia unites with the acid, and daturia is precipitated and obtained by evaporation. This substance, as a neutral salt, is powerfully narcotic and sedative, destroying animals in doses of three or four grains. It has not been employed medicinally.

Medical Properties.—It is powerfully narcotic, and requires to be given with caution. In overdoses it occasions vertigo, headache, dimness of sight, confusion of intellect, and a delirium like intoxication, feeling of fulness about the fauces, with sense of suffocation, and some tendency to sleep. In still larger doses these symptoms are aggravated; there will also be complete loss of vision, with dilatation of the pupil, delirium, stupor, paralysis, and sometimes death. To meet such occurrences, stimulating emetics are indicated, and the use of the stomach-pump. Stramonium appears powerfully to diminish the sensibility of the nervous system, so that ordinary emetics will sometimes not act; consequently sesquicarbonate of ammonia and mustard are particularly indicated; afterwards, diffusible stimulants and anti-narcotic remedies should be employed, such as strong infusions of tea or coffee. Vinegar may be useful if there is not too much depression.

Stramonium may be serviceable in many diseases, the pathology of which is obscure, and in which, if pain be relieved, the patient is satisfied, or where there is irregular nervous action. It is hence given in mania, epilepsy, neuralgic and rheumatic affections, syphilitic and cancerous sores, and spasmodic asthma. It is of most service in the latter, given in repeated doses during the paroxysm. With the same intention, and sometimes effect, the plant is smoked like tobacco. Care must be taken that it is not used where there is much plethora, or copious secretion in the bronchial tubes, as, by deadening the nervous sensibility the accumulation of mucus is less felt, and may be increased to such an extent as to induce asphyxia.

This substance has been externally applied in the form of fomentation, plaster, or poultice, to irritable ulcers, inflamed tumours, swollen and painful breasts, and hæmorrhoids. It acts like belladonna, in dilating the pupil, applied in a similar manner.

As a medicinal agent, stramonium is not very certain in its operation, and, if continued, the dose must be gradually increased. On some it has a deleterious influence even in small quantities.

Dose.—Of the powdered leaves, gr. ss to gr. ij.
Of the extract, gr. ¼ to gr. ij.

Prep.—Extractum Stramonii.

STRYCHNIA.

Strychnia. The active principle of Nux Vomica may be obtained in the following manner: bruise the seeds of

Nux Vomica, and digest them in rectified spirits, by means of which we have taken up in solution strychnate of strychnia, with resin and colouring matter; evaporate this to remove the spirit, and treat the residue with boiling water, to take up the strychnate of strychnia with the colouring matter and leave behind the resinous matter; then evaporate the solution to the thickness of syrup and add to it magnesia, which will unite with the strychnic acid, and the strychnia will be set free; to this add hot spirit, which will dissolve out the strychnia with the colouring matter, leaving behind strychnate of magnesia; pour off the solution, and evaporate, and take up the residue with dilute sulphuric acid, and to the solution add charcoal to decolourize, and finally add ammonia, by which we have sulphate of ammonia in solution, and strychnia is precipitated in a pure state. For *Medical Properties*, see Nux Vomica.

STYRAX.

The balsam or concrete juice of a doubtful tree, named by some STYRAX OFFICINALE. *Storax Tree.*

This tree grows to about 15 or 20 feet high. It is a native of Syria and the Levant, and is now naturalised in the south of France and Italy.

Storax is obtained in Asiatic Turkey by making incisions in the tree. The drug is described as imported in several conditions; in fine grains of a yellow colour, and of the size of a pea, capable of uniting into a mass. The form of it, which is most common, is in reddish-brown masses, like lumps of dark sawdust impregnated with storax, which this yields either to pressure or rectified spirit. It is also sent over in the form of a thick viscid liquid.

Liquid storax, according to Simon, contains volatile oil, cinnamic acid, styracine, with a hard and soft resin.

Storax has a fragrant odour, which it imparts to water. It is very combustible; soluble in alcohol and ether. It yields benzoic acid by distillation, and contains resin and volatile oil.

Medical Properties.—Stimulating, expectorant, and diuretic, but seldom used. It might be given in leucorrhœa, and gonorrhœa as a substitute for Copaiba.

Dose.—Gr. x to gr. xx, twice or thrice in a day.

Prep.—Tinct. Benz. comp.,—Pil. Styr. c.

SULPHUR SUBLIMATUM, and SULPHUR PRÆCIPITATUM.

Sublimed Sulphur.—Sulphur is an elementary nonmetallic solid, found in a free state or in combination with metals, forming sulphurets which are very abundant. The sulphur of commerce is chiefly derived from the sulphur earths, which are most plentiful in Italy and Sicily. It is extracted from the earths by placing them in furnaces, which have tubes passing from them to transmit the sulphur into water prepared to receive it; this sulphur is impure, and is known by the name of crude sulphur. For purification it is melted in cast-iron vessels; when the impurities subside, the sulphur is ladled out and poured into cylindrical wooden moulds, which give it the form of cylinders, known as *roll sulphur*. The dregs of the process form an impure sulphur, known by the name of *sulphur vivum*.

Another mode of purification consists in distilling or subliming the crude sulphur into rooms, where it condenses: if the rooms are small and much heated, it runs down the sides in a liquid state, and may be cast into rolls; if the room is capacious and cooler, it will be condensed in the form of a fine powder, named *sublimed sulphur*, or *flowers of sulphur*.

Sulphur may also be procured from the sulphurets, more especially of iron, which is practised in the island of Anglesea and in Sweden. Sublimed sulphur, as imported, is always contaminated with a little sulphurous or sulphuric acid, which is formed during its sublimation, by the medium of the air; on this account sublimed sulphur always reddens litmus, and is ordered to be washed for medical use, to remove any acid.

Sulphur Præcipitatum.—Precipitated sulphur, again introduced into our Pharmacopœia, is made by heating sulphur, lime, and water together, by which we have formed a sulphuret of calcium and hyposulphite of lime, and when to this hydrochloric acid is added, decomposition ensues, and we have formed water, chloride of calcium, and free sulphur precipitated. This form of sulphur is of a pale yellowish-green colour, soft and spongy to the feel, with very little odour or taste. It is often adulterated with sulphate of lime. It has similar properties to the sublimed sulphur, and is more agreeable as an internal remedy.

Medical Properties.—Laxative and diaphoretic. As a laxative, sulphur is very mild in its operation, unless it contains a good deal of acid, when it produces griping. It is serviceable in hæmorrhoids, and has obtained reputation in chronic gout and rheumatism, asthma, and other affections of the respiratory organs not attended with inflammation. The ease with which it escapes by the skin is very remarkable: if persons taking it freely, carry about them silver, it will soon be blackened by sulphur combining with it; this is most readily perceived in warm weather. Externally sulphur is much used in the form of ointments, in the treatment of skin diseases, particularly the itch, for which it may be considered a specific.

Sulphur may be given either in milk, treacle, or syrup.

Dose.—As a laxative, ʒij to ʒiv.

Prep.—Hydrargyri Sulphuretum Nigrum et Rubrum,—Potassii Sulphuretum,—Unguentum Sulphuris,—Ung. Sulph. comp.

TABACUM.

The leaves of NICOTIANA TABACUM. *Common Tobacco Plant.*

This plant is an annual, rising from three to six feet in height. It is generally considered to be a native of America, but is now cultivated in a great many countries; with us it flourishes very well, although its cultivation to a large extent is prohibited in consequence of the large sum obtained by government by the duty paid on its importation. The leaves, which are officinal, are very large, ovato-lanceolate, alternate, sessile, somewhat decurrent, slightly viscid, and of a light green colour. The plant is very abundantly cultivated in Maryland and Virginia.

Two varieties of this species of tobacco are mentioned by authors: one with narrow, the other with broad leaves. They do not, however, differ much in their qualities. Tobacco varies most from the soil, climate, and mode of cultivation.

The leaves of tobacco impart their properties to water and alcohol, but they are destroyed by long boiling in

Albumen . . . .
Substance analogous to gluten . .
Malic acid . . . . . .
Malate of ammonia . . . . .
Sulphate of potash . . . . .
Chloride of potassium . . .
Potash with malic and nitric acid .
Phosphate of lime . . . . .
Lime . . . .
Silica . . . .
Lignin . . . .
Water . . . .

Nicotin, or nicotina, is a liquid, colo
parent, possessing an odour like tobacc
disagreeable, burning taste. It is infla
in water and in ether, has alkaline prope
with acids to form salts. It is a po
animals.

Formula $C^{20} H^{14} O^{2}$.

Nicotianin is the odorous principle o
a fatty substance, having an aromatic and
an odour like tobacco smoke. It is vol
insoluble in water, soluble in alcohol
affected by dilute acids, but dissolved by
potash.

When distilled at a heat above boilin
yields an empyreumatic oil, which is
and which is believed to hold the narc

belladonna. It is not a very suitable remedy for internal administration; almost the sole medical use now made of it is in the form of enema, in the treatment of strangulated hernia, tetanus, and by a few practitioners in peritonitis and enteritis; in tetanus, its good effects have been more decided than perhaps those of any other remedy yet employed; the objection to its use is, the extreme prostration which attends its action, and which cannot always be limited to the extent of our wishes. Even in hernia it is rarely prescribed, compared with former times, on account of having been considered to be the cause of death in cases which exhibited no signs of rapid sinking previously. It appears to operate on the heart and brain. The proper quantity of the enema to be used is six to eight ounces, which may be repeated if necessary. Tobacco-water has been employed externally as a wash in some skin diseases, and apparently with good effect. Should there be excoriation, its application to the bodies of children would be attended with danger.

Prep.—Enema Tabaci.

TAMARINDUS.

The pulp of the legume of TAMARINDUS INDICA. *Tamarind Tree.*

This tree is a native of the East and West Indies, Egypt, and Arabia. It attains a considerable height, sending off spreading branches, and presenting a very beautiful appearance. The fruit is a pod, broad, compressed, ash-coloured, from two to six inches long; with numerous flat, rather quadrangular seeds, contained in cells formed by a tough membrane. Exterior to this is a light-coloured, acid, pulpy matter, between which and the shell are several tough ligneous strings running from the stem to the extremity of the pod. The shells are brittle and easily separated.

Tamarinds are chiefly imported from the West Indies, where they are prepared by placing the pods, previously deprived of their shell, in layers in a cask, and pouring boiling syrup upon them. Another method is to place them in stone jars, with alternate layers of powdered sugar. From the analysis of Vauquelin, 100 parts of tamarinds contain, independently of the sugar added to them—

Citric acid	9·40
Tartaric acid	1·55
Malic acid	0·45
Bitartrate of potash	3·25
Gum	4·70
Jelly	6·25
Parenchymatous matter	34·35
Water	27·55

Traces of copper are sometimes detected in tamarinds, in consequence of being prepared in copper vessels.

Medical Properties.—Tamarinds are laxative and refrigerant. They form, with water, a pleasant cooling drink in fevers. As a laxative medicine, tamarinds are rarely used alone, but are combined with other substances, as in the confection of senna.

Dose.—℥ss to ℥j.

Prep.—Conf. Cassiæ,—Conf. Sennæ.

TARAXACUM.

The root of TARAXACUM DENS-LEONIS, *alias* LEONTODON TARAXACUM. *Dandelion.*

This herbaceous plant is indigenous, and may also be found in most parts of the world. The root is perennial, fusiform, and is officinal. The leaves have a slightly bitter taste, and are used as a salad by some persons in this and other countries, probably on account of the medical qualities which they are supposed to possess.

The root is several inches in length, of a light brownish colour externally, whitish within, and abounding with a milky juice. It is without smell; has a sweetish, mucilaginous, rather bitter taste. It yields all its properties to boiling water. In the milky juice John found bitter extractive, gum, caoutchouc, saline matter, a trace of resin, and free acid, also starch and saccharine matter.

Medical Properties.—Slightly tonic and diuretic, and thought to be useful in unloading the gorged vessels of the liver. It is a very mild remedy. The diseases in which it is most given are congestion and chronic inflammation of the liver and spleen, jaundice, and some dropsical affections, depending on obstruction of the abdominal viscera.

Dose.—Of the extract, gr. xx to ʒj.

Prep.—Extr. Taraxaci,—Dec. Scop. c.

TEREBINTHINA CANADENSIS.

The liquid resin of ABIES BALSAMEA. *American Silver Fir.*

This tree inhabits Canada and Nova Scotia. The resin is procured by breaking the vesicles which form in the trunk, and receiving the liquid in bottles. When fresh it is almost colourless, transparent, of a consistence like thin honey, very tenacious, with a strong odour, and a bitterish, somewhat acrid taste. By time it becomes gradually thicker, and finally solid. It is sometimes named Balm of Gilead. It consists of resin and volatile oil, sub-resin, fibrous caoutchouc, bitter extractive, salts, and a trace of acetic acid. It is chiefly used as a varnish or cement by opticians, and for microscopical purposes.

TEREBINTHINA CHIA.

The liquid resin of PISTACIA TEREBINTHUS.

This is a small tree, a native of Barbary and Greece, now flourishing in the islands of Cyprus and Chio, from the latter of which the drug derives its name. The turpentine is collected by making incisions in the tree during the summer; the liquid which exudes is received upon stones placed at the bottom, and then scraped off and dropped into bottles. It is a thick pellucid liquid, of a yellowish colour, a penetrating rather agreeable odour, and a mild, slightly bitter taste. By exposure to the air it gradually thickens, and becomes ultimately hard and brittle.

TEREBINTHINA AMERICANA, alias TEREBINTHINA VULGARIS.

The liquid resin of PINUS PALUSTRIS and PINUS TÆDA.

This substance, formerly said to be the produce only of the Pinus Sylvestris, is now brought largely from America, and is said to be chiefly obtained from the trees designated in the London Pharmacopœia. There is still great obscurity resting on the subject. The liquid resin is procured by making incisions in the trunk of the tree, or removing a portion of the bark, and receiving the juice, which exudes in small troughs or holes, dug at the foot of the tree. It is purified by heating and straining. When prepared it is white, turbid, and thick, and upon standing, separates into two parts, one very liquid, the other like thickish honey. From this substance, by heat, we procure large quantities of turpentine, and a resin commonly called *rosin*, the *resina flava* of the Pharmacopœia.

The three turpentines above mentioned, and a host of others, resemble each other much in colour, odour, and taste. Water extracts very little of their volatile oil: they are wholly soluble in alcohol, and unite readily with the fixed oils. They consist essentially of resin and a volatile oil, which may be separated by distillation. With this oil, it is said that a minute portion of succinic acid is combined.

Medical Properties.—The turpentines are stimulant, diuretic, anthelmintic, and purgative. Either taken internally or applied to the surfaces, they impart a peculiar odour to the urine, something like violets, and often occasion irritation of the mucous membrane of the urinary passages, sometimes amounting to strangury. Externally they act as rubefacients. They are occasionally prescribed in leucorrhœa, gleet, and other chronic diseases of the urinary passages; sometimes in piles, chronic catarrhal affections, sciatica, and lumbago. They may be given in the form of pill, or in emulsion with mucilage of acacia, the yolk of egg, or syrups.

Dose.—℈j to ʒj.

TEREBINTHINÆ OLEUM.

The oil distilled from Terebinthina Vulgaris.

This oil is easily separated from the resin, and the quantity procured is generally about 20 per cent.

It is limpid and colourless, of a strong odour, and a warm pungent taste. It is volatile, and highly inflammable, slightly soluble in water, more freely in alcohol, completely so in ether; exposed to the air and light it deposits a white solid matter in crystals, which are without taste and smell, insoluble in cold water, but soluble in ether and alcohol. By transmitting hydrochloric acid gas through this liquid, a white crystalline substance is formed, named artificial camphor. By keeping and exposure to the air, the oil absorbs oxygen, becomes thicker and yellowish, and loses part of its activity. Its composition is $C^{20} H^{16}$.

Medical Properties.—Oil of turpentine is stimulant, diuretic, purgative, anthelmintic, and externally rubefacient. When taken in moderate quantities, it quickens the pulse, increases the heat of the skin, produces warmth of the stomach, without much affecting the brain. It also stimulates the kidneys to increased secretion, and sometimes causes irritation of them, a discharge of bloody urine, and strangury. In large doses it occasions vertigo, a sense of fulness in the head, intoxication, and often brisk catharsis. When it purges speedily and briskly, it does not affect the kidneys, as it is liable to do if given in smaller doses insufficient to purge. It has also a remarkable effect upon bleeding vessels, either on the surface or in the cavities.

The diseases in which this oil has been found useful are very numerous. In low typhus fever, towards the latter period, it is often a valuable stimulant, especially where the bowels are distended with flatus, there is probably an ulcerated state of the bowels, and low delirium. It has been found serviceable in puerperal fever, or peritonitis, chronic rheumatism, sciatica, lumbago, in epilepsy, tetanus, passive hæmorrhages, particularly from the intestinal canal, in some forms of chronic diarrhœa and dysentery, gleet, leucorrhœa, and in chronic nephritic affections.

As an althelmintic, it is one of the best remedies for tænia, and for this it is more used than in the treatment of any other morbid condition. It is prescribed in such a way, that it should purge freely, and that it may not be absorbed and irritate the kidneys. It is most likely that it destroys the worm first, and then facilitates its expulsion. It may also be taken for the lumbrici, which it kills, and converts into dead animal matter. The oil is given likewise in dropsies as a diuretic; in amenorrhœa to stimulate the torpid uterine vessels; and might be employed as a local stimulant and carminative in flatulent colic and gout of the stomach. It is prescribed by surgeons in some cases of iritis, in which it is necessary to abandon the use of mercury.

The dose for ordinary purposes is from fifteen to thirty minims, repeated every third or fourth hour, or in chronic cases three times a day. In rheumatism some have given it in drachm-doses every fourth hour. In tape-worm, it is given in doses of one ounce to two ounces, and should be followed by castor oil, if it does not operate in half an hour. Some give an ounce of castor oil and the same of oil of turpentine together, which is a very good plan. In cases of other worms it may be administered in smaller doses, as half a drachm to two drachms repeated.

In the form of enema, it is very serviceable for the removal of ascarides, also in obstinate constipation or tympanitic distension of the bowels. From half an ounce to two ounces may be used in this way, mixed with gruel or other bland liquid.

Externally applied it is rubefacient, and when heated even vesicant. As a liniment it is useful in rheumatism and paralytic affections, and various internal inflammations. Generally it should be mixed with some bland oil to moderate its irritating qualities, as it sometimes causes very high inflammation of the skin and an extensive eruption. Mixed with oil, it is dropped into the ear, with great efficacy, in cases of deafness depending upon a viscid state of the cerumen, or deficient secretion of it. It is much employed as an application to extensive burns, especially when the epidermis is removed; and it is remarkable that, instead of producing the most intense pain and smarting, as might be anticipated from its general action, on the contrary, it has a soothing effect, and even feels cool to the parts on which it is applied. In the same cases it is afterwards applied in conjunction with unguentum resinæ, to stimulate the parts to healthy action.

Prep.—Lin. Terebinthinæ,—Ol. Terebinthinæ rectificatum,—Enema Terebinthinæ.

THUS.

Frankincense. *Vide* ABETIS RESINA.

TIGLII OLEUM.

The oil expressed from the seeds of CROTON TIGLIUM.

This species of Croton is a small tree or shrub, a native of Hindostan, Ceylon, the Moluccas, and many other parts of India. The fruit is a smooth capsule, about the size of a filbert, with three cells, each containing a single seed; every part of the tree is pervaded by an acrid principle, and the root is sometimes used in the East as a purgative. The wood is also purgative, diaphoretic, and emetic. The seeds, however, contain the qualities of the tree in the most concentrated form. They were much used many years ago, and were named Molucca grains; but as they acted with great violence, they grew into disuse, till of late years, and now are classed amongst our standard remedies. The oil only of the seeds is officinal.

The seeds are of the size of a grain of coffee; the shell is covered with a yellowish-brown epidermis, beneath which the surface is black and smooth: the epidermis being sometimes partially removed, gives the seeds a mottled appearance; sometimes they appear quite black. The kernel within is of a yellowish-brown colour, and abounds in oil. The kernel of one to two seeds is a very efficient purgative.

The oil is procured from the kernel by pressure, after the shell is removed; or it may be separated by decoction in water, or by the assistance of ether, which will dissolve out the oil, and leave it when evaporated. According to Dr. Nimmo the seeds consist of sixty-four parts of kernel, and thirty-six of envelope; and the kernel yields about 60 per cent. of oil.

The oil has usually a reddish-yellow tinge, but without heat may be procured almost colourless. It has a peculiar odour, and a hot acrid taste, which is followed by heat in the fauces, likely to last some hours. It is wholly soluble in sulphuric ether and oil of turpentine, partially so in alcohol. Dr. Nimmo found in it two distinct substances, one the acrid purgative principle, amounting to 45 per cent., soluble in cold alcohol, and having an acid reaction, the other a mild oleaginous substance like olive oil, soluble in ether and oil of turpentine, insoluble in cold alcohol. This oil is adulterated sometimes with castor oil, which is detected with difficulty, if in small quantity; and is thought to be mixed when imported with the oil of another purging plant, the Jatropha Curcas, the properties of which are similar, but milder.

Medical Properties.—Croton oil is a powerful drastic and hydragogue cathartic. In small doses it acts mildly, but in larger ones nauseates, produces vomiting, and hypercatharsis. It is very speedy in its operation, generally commencing before the expiration of half an hour. The stools resulting from it are very liquid, containing a large quantity of serous fluid, mucus, and some bile. It is valuable in cases of mania, apoplexy, and paralysis, placed upon the tongue, when the patient is unable or will not swallow. In this way, it gradually passes down, and generally suffices for clearing out the bowels. It is an useful adjunct to other purgatives, when we want to increase their activity. When applied to the surface of the body by friction, it occasions an eruption, which becomes pustular. For this object it is prescribed in rheumatism, gout, neuralgia, grandular and other indolent swellings, and some pulmonary diseases. In this way it sometimes purges, if three or four drops are used. As an embrocation, it requires to be diluted with olive oil, or oil of turpentine, or soap liniment.

Croton oil is best administered in the form of pill, as in a liquid state it is almost certain to irritate the fauces, and cause a burning sensation, which is very annoying. Another good plan is to get some wafer paper, used by confectioners, and take a piece of the size of a crown-piece, and dip it in water; place this upon the hollow of a spoon, and drop upon the centre of it the dose of croton oil, then roll the moist paper around it, and swallow it; it passes down very easily, as much so as an oyster, and the medicine is not in the slightest degree tasted. In the same manner powders may be given to children or grown-up persons who have a great aversion to the taste of medicine.

Dose.—One drop to two or three: for the first time, half a drop is quite sufficient when the oil is good.

TORMENTILLA.

The root of POTENTILLA TORMENTILLA. *Septfoil.*

This plant has an annual herbaceous stem, and a perennial root; is found in many parts of England, and other parts of Europe. The root only is officinal, although similar qualities exist in the other parts of the plant.

The root somewhat resembles bistort-root, but is distinguished by its lighter colour; it is more knotted and irregular in its figure, and has not the pink appearance inside observable in the other root. Its chief active constituent is tannin. Besides this, there is a red colouring principle, soluble in alcohol, but insoluble in water. The root yields its medical virtues in boiling water.

Medical Properties.—Tormentil is a mild astringent, adapted to all cases which require similar remedies. It is rarely used except in the form of the compound chalk powder. A decoction of it is a very good and safe injection in gonorrhœa and gleet.

Dose.—Of the powder, ʒj to ʒij.

Prep.—Pul. Cret. comp.,—Decoctum Tormentillæ.

TRAGACANTHA.

The concrete juice of Astralagus Verus.

This is a small shrub, two or three feet high. The stem is about an inch thick, branched, and prickly from the scales, which are formed upon it. It yields the gum which is collected in Persia, and transmitted to India and Aleppo. Tragacanth exudes spontaneously during the summer, from the stem and branches upon which it concretes.

This drug varies considerably in its appearance and degree of purity. It is hard and brittle, but pulverized with some difficulty. It has no smell, and little taste. Put into water it swells considerably, and forms a soft adhesive mass, but is not dissolved. This triturated with some more water, may be thoroughly blended, and on standing a day or two, a great part of it will subside. Tragacanth is wholly insoluble in alcohol. It is classed with gum, but differs in some particulars. With water it forms a much more viscid liquid, being from ten to thirty times more powerful. It appears to be composed of two parts, one soluble in water, resembling gum arabic; the other swells in water, but is insoluble. The latter constitutes about 43 per cent., and has been named *Tragacanthin* or *Bassorin*, and by some chemists is considered to be a modification of cerasin, cherry-tree gum.

Medical Properties.—Tragacanth is demulcent, and, on account of the viscid compound it forms with water, is much used to suspend heavy substances in the form of powder. It also enters into the composition of lozenges.

Prep.—Pulv. Trag. c.,—Conf. Opii.

VALERIANA.

The root of VALERIANA OFFICINALIS (variety, SYLVESTRIS). *Common Valerian.*

This plant has an herbaceous annual stem, and a perennial root. It is common in many parts of the country, growing either in moist meadows or on elevated dry situations. The plant occupying the latter places is preferred. The root only is officinal.

This root consists of several fibres attached to a caudex. It has a light brown colour, has a strong odour when dry, resembling that which may be perceived where cats congregate. This possibly is the reason that cats have an extraordinary liking for the odour of this drug, for they are attracted to it like a charm from a considerable distance. The taste of the root is rather bitter and aromatic. It yields its virtues to water and alcohol.

The chief constituents of this root are a volatile oil, valerianic acid, with extractive matter, gum, and lignin. Many chemists believe that the acid does not exist ready formed in the plant, but is rather an educt from transformation of the oil or other ingredients, aided by heat and water.

Medical Properties.—Valerian is a mild stimulant and antispasmodic, rousing the nervous system without cerebral congestion or narcotic symptoms.

The diseases in which it is most given are hysteria, hypochondriasis, epilepsy, hemicrania, low fevers with irregular nervous action, intermittents in combination with cinchona, and in that nervous condition and restlessness which is so often observed in elderly people.

It should be administered either in powder or the tinctures, as infusion or decoction would be less likely to be efficacious, on account of the heat dissipating the volatile oil on which the virtues of the root mainly depend.

Dose.—Of the powder, ℈j to ʒj.
tincture, ʒj to ʒiij.
ammoniated tincture, ʒss to ʒij.

Prep.—Tinct. Valerianæ,—Tinct. Valer. Ammon.

VERATRUM.

The root of VERATRUM ALBUM. *White Hellebore.*

This plant has a perennial, somewhat fusiform, rhizome, and an annual herbaceous stem. It is a native of the Alps and Pyrenees. All parts of the plant are acrid and poisonous, but the rhizome only is officinal. It is imported from France and Germany.

The fresh rhizome has a disagreeable odour, which is lost by drying. The taste is at first sweetish, afterwards rather bitter, acrid, burning, and durable. Analysed by Pelletier and Caventon, it yielded—

An oily matter, containing elain, stearin, and a volatile acid; supergallate of veratria; yellow colouring matter; starch; gum; lignin; silica, and salts of lime and potash.

The most active principle is the veratria.

Veratria is white, pulverulent, inodorous, extremely acrid, scarcely at all soluble in cold water, soluble in 1000 parts of boiling water, dissolved freely by alcohol, less so by ether, capable of neutralizing acids and forming salts, of which none but the sulphate and hydrochlorate is crystallizable. Veratria may be procured from this root in the following manner: make a decoction, filter it, and add a solution of acetate of lead as long as any precipitate falls. Then remove the solution containing acetate of veratria, and a little acetate of lead. To this introduce hydrosulphuric acid, to precipitate the lead. The liquid may then be heated to drive off the excess of acid. To this add magnesia, which will combine with the acetic acid, and the veratria will be precipitated. Collect this, wash it with water, dry it, and treat with boiling alcohol, which will dissolve the veratria, and yield it in a solid state by evaporation.

Medical Properties.—White hellebore is a powerful emetic and cathartic, too violent to be used without extreme caution. It is also a strong errhine. If it be taken in over-doses it occasions hypercatharsis with bloody stools, and great prostration. It was a favorite remedy with the ancients in mania, dropsy, epilepsy, and some skin diseases. With us it is less favorably viewed. Some have thought that it is an ingredient in the famous Eau Medicinale d'Huisson, and have employed the wine of it, with the wine of opium, as a substitute in the treatment of gout and rheumatism. If a little of the powder be snuffed up the nose, it occasions most powerful sneezing, sometimes attended with danger, and often with vertigo. Such remedies are not now in fashion. If it be used for this purpose it is better to dilute it with 10 times its quantity of starch, and snuff up half a grain or a grain at once. We use it, however, externally, in the treatment of itch, either in decoction or ointment, but with rather questionable success.

Veratria acts upon the body in a very similar manner, and, being very powerful, requires to be given with the utmost caution.

Dose.—Of the wine, ♏ xx to ♏ xxx.

Prep.—Decoct. Veratri,—Vinum Veratri,—Ung. Sulph. comp.,—Ung. Veratri.

VINUM XERICUM.

Sherry is the form of wine selected for making the preparations termed wines in the Pharmacopœia. It contains about 20 per cent. of alcohol, and is esteemed for its dryness or freedom from acidity. It is often prescribed in preference to others for invalids during their convalescence.

Prep.—Vina Varia.

VIOLA.

The fresh petals of VIOLA ODORATA. *Common Violet.*

This plant is too well known to need a description. The flowers contain a colouring matter, which is easily affected by acids or alkalies. Acids redden it; alkalies turn it to green.

Medical Properties.—It is supposed to be gently laxative, and the syrup may be given to children in doses of a tea-spoonful to a table-spoonful.

ULMUS.

The bark of ULMUS CAMPESTRIS. *Common Elm Tree.*

This tree is indigenous, and grows in all parts of the country; the inner bark of the branches is the officinal portion. It is thin, tough, of a yellowish-brown colour, inodorous, with a mucilaginous somewhat bitter taste. It imparts its qualities to water. Iodine indicates the presence of starch. Chemists have discovered in it a peculiar vegetable principle, which they name ulmin, considered to be a constituent of most barks; it is of no decided use in medicine.

Medical Properties.—Elm bark is demulcent, possibly diuretic and alterative. It is chiefly employed in skin diseases, in which it will do most service by being a vehicle for something more active. It is given in decoction, and may be drunk liberally for several days.

Prep.—Dec. Ulmi.

UVA.

The Raisin.—The dried fruit of VITIS VINIFERA.

The grape-vine is too well known to need any description. In warmer climates than our own the grapes attain a very considerable size, and when prepared in a particular manner, form the raisins of the shops.

Raisins are prepared by partially cutting the stalks of the bunches before they are ripe, and allowing them to dry on the vine; or by picking the ripe fruit and steeping it for a short time in an alkaline solution before desiccation. Those prepared by the first method are preferred. Several varieties of raisins are known in commerce, the best of which are from *Malaga* and *Valentia*. The Turkey raisins are the common kind, used generally in puddings and cakes. They are brought from the coast of Syria.

Raisins contain a much larger proportion of sugar than the fresh grapes. It is so abundant that it sometimes concretes on their surface, or in separate masses within the substance of the raisin. This sugar differs somewhat from common sugar, being less soluble in water and alcohol.

Medical Properties.—Raisins are only used in medicine on account of their saccharine qualities. Eaten in large quantities they are laxative, but very prone to cause flatulence and severe griping.

Prep.—Decoctum Hordei comp.,—Tinct. Card. comp., —Tinct. Sennæ comp.

UVA URSI.

The leaves of ARCTOSTAPHYLOS UVA URSI. *Bear-berry.*

This is a small evergreen shrub, found in the northern latitudes of Europe, Asia, and America. The leaves of the officinal portion are obovate, acute at the base, entire; with a rounded margin, thick, coriaceous, shining, of a deep green colour on their upper surface, underneath paler, and covered with a network of veins. The fresh Uva Ursi leaves are inodorous, but when dried and powdered possess an odour like hay: their taste is bitter, strongly astringent, and ultimately sweetish. Water and alcohol extract the active principles. Amongst the ingredients we find—

Tannin; bitter extractive; resin; gum; gallic acid.

The tannin is so abundant, that in Russia the leaves are used for tanning.

Medical Properties.—Uva Ursi is astringent and tonic, and some even consider it to be diuretic. It has been thought also to be antilithic, and been found serviceable in gravel, probably by giving tone to the digestive organs, and preventing the accumulation of principles which may contribute to a calculous deposit. It is often prescribed in chronic nephritis, or cases in which there is a suspicion of ulceration in the kidneys, uterus, or bladder. The other diseases in which it is imagined to do good are diabetes, catarrh of the bladder, incontinence of urine, gleet, leucorrhœa, and even phthisis pulmonalis, according to Dr. Young.

Dose.—In powder, ℈j to ʒss.
In the form of decoction, in doses of one to two ounces.

Prep.—Dec. Uvæ Ursi.

ZINCUM.

Metallic Zinc.—Zinc is never found in a metallic state.

The most common ores of it are the sulphuret, named blende; and the carbonate, named calamine, and the red oxide, which is very abundant in the United States. We generally procure zinc from its ores by the action of heat and the assistance of charcoal. At first obtained, it is very impure, but is subsequently sublimed and received in water, where it concretes and is separated from the impurities; we call this distilled zinc.

As a medicine, pure zinc is not used. It is employed in pharmacy to prepare that useful salt, the sulphate of zinc.

Sulphate of zinc is tonic and astringent in small doses; in larger ones, emetic. It is used also in collyria, in the quantity of one to three grains in an ounce of water; and in a stronger solution is employed as an injection in gleet and leucorrhœa.

This salt ranks high as an emetic, in cases of poisoning, as it operates promptly, empties the stomach, and does not debilitate the system. It is one of those named tonic and direct emetics. The diseases benefited by it in small doses are chorea, epilepsy, diarrhœa, chronic dysentery, intermittent fever, chronic catarrh, hooping-cough, and many others. It is not likely to occasion symptoms of poisoning, as by its emetic qualities it works its own cure. In testing for it, we may remark, that all the precipitates commonly procured have a white colour, even that from hydrosulphuric acid. When alkalies are added to its solution, they combine with the acid, and precipitate the white oxide of zinc.

Dose.—As a tonic and astringent, gr. j to gr. iij.
As an emetic, to empty the stomach in disease, gr. x to gr. xx.
In cases of poisoning, ʒss to ʒj.

Prep.—Zinci Oxydum,—Liq. Aluminis compositus.

ZINGIBER.

The root-stock of ZINGIBER OFFICINALIS. *Ginger-plant.*

This plant has a perennial, creeping, tuberous, rhizome; and an annual stem, which rises two or three feet high. It is a native of Hindostan, and is cultivated in all parts of India; also in the West Indies, whither it was transplanted from the East. The root-stock or rhizome is the part in which the virtues of the plant reside. This is fit to be dug up when a year old. After being properly cleaned it is scalded in boiling water to prevent germination, and is then rapidly dried. Thus prepared, it forms the ordinary or black ginger of commerce. In the West Indies it is prepared by selecting the best root-stocks, depriving them of their epidermis, and drying them separately in the sun. This is called white ginger, and is most highly valued. A preserve is made from ginger by selecting the root-stock while young and tender, depriving it of the cortical covering, and boiling it in syrup. It is imported in this state both from the East and West Indies.

The odour of ginger is aromatic, the taste spicy, pungent, hot, and biting. These qualities are gradually lost by long keeping and exposure of the root. The virtues of ginger are taken up by water and alcohol. The constituents, according to Mr. Morin, are—

Volatile oil, of a greenish-blue colour; resinous matter, soft, acrid, aromatic, soluble in ether and alcohol; a sub-resin, insoluble in ether; a little osmazome; gum; starch; sulphur; acetic acid, and acetate of potash; lignin.

The odour or flavour depends upon the volatile oil, its pungency on the resinous or resino-extractive principle. A considerable quantity of pure white starch may be extracted from it.

Medical Properties.—Ginger is a pleasant stimulant and carminative, often given in dyspepsia, flatulent colic, and the weak state of the alimentary canal in atonic gout. It is most used as an adjuvant or corrective of other medicines, to make them more palatable, warmer to the stomach, or to prevent griping. When chewed it irritates the mouth, and if moistened and applied to the skin is rubefacient, and sometimes even blisters. It may be given in powder, infusion, or tincture.

Dose.—Gr. x to gr. xx.

Prep.—Conf. Opii,—Conf. Scamm.,—Pil. Camb. comp.,—Pil. Sagap. comp.,—Pulv. Cinnam. c.,—Pulv. Jal. c.,—Pulv. Scamm. c.,—Syr. Zingib.,—Tr. Cinnam. c.,—Tr. Rhei comp.,—Tinct. Zingib.

TABLE,

SHOWING THE PROPORTION IN WHICH OPIUM, AND CERTAIN PREPARATIONS OF ANTIMONY, ARSENIC, AND MERCURY, ARE CONTAINED IN SOME COMPOUNDS.

OPIUM.

Confectio Opii.
Thirty grains contain one grain of opium.

Pil. Saponis comp. and *Pil. Styracis comp.*
Five grains contain one grain of opium.

Pulvis Cretæ compositus cum Opio.
Two scruples contain one grain of opium.

Pulvis Ipecacuanhæ compositus.
Ten grains contain one grain of opium.

Pulvis Kino compositus.
One scruple contains one grain of opium.

Tinctura Opii.
Nineteen minims contain about one grain of opium.

Tinctura Camphoræ composita.
Four fluid drachms contain nearly one grain of opium.

ANTIMONY.

Vin. Ant. Potassio-tartratis.
One fluid ounce contains two grains of tartarized antimony.

MERCURY.

Hydrargyrum cum Cretâ.
Three grains contain one grain of mercury.

Liquor Hydrargyri Bichloridi.
An ounce contains half a grain of the bichloride of mercury.

Linimentum Hydrargyri.
Six drachms contain one drachm of mercury.

Pilula Hydrargyri.
Three grains contain one grain of mercury.

Pilula Hydrargyri Chloridi composita.
Six grains contain about one grain of the chloride of mercury.

Unguentum Hydrargyri Fortius.
Two drachms contain one drachm of mercury.

Unguentum Hydrargyri Mitius.
Six drachms contain one drachm of mercury.

ARSENIC.

Liquor Potassæ Arsenitis.
Two fluid drachms contain one grain of the arsenious acid.

TABULAR ARRANGEMENT OF PLANTS
USED MEDICINALLY,

AND OF THOSE MENTIONED IN THE CATALOGUE OF THE CHELSEA BOTANIC GARDEN.

With the Classes and Orders according to the Sexual Arrangement of Linnæus, and the Natural Orders chiefly according to Lindley.

Botanical Name.	*Class.*	*Order.*	*Natural Order.*
Acacia Catechu	Polygamia	Monœcia	Leguminosæ
——— Vera			
Acinula Clavus	Cryptogamia	Fungi	Fungaceæ
Aconitum Napellus	Polyandria	Trigynia	Ranunculaceæ
——— Paniculatum			
Acorus Calamus	Hexandria	Monogynia	Acoraceæ
Æsculus Hippocastanum	Heptandria	Monogynia	Æsculaceæ
Agrimonia Eupatoria	Dodecandria	Digynia	Rosaceæ
Allium Cepa	Hexandria	Monogynia	Liliaceæ
——— Porrum			
——— Sativum			
Aloe Spicata	Hexandria	Monogynia	Liliaceæ
—— Vulgaris			
Athæa Officinalis	Monadelphia	Polyandria	Malvaceæ
Alpinia Cardamomum	Monandria	Monogynia	Zingiberaceæ
Amygdalus Communis	Icosandria	Monogynia	Rosaceæ
Amyris Elemifera	Octandria	Monogynia	Amyridaceæ
——— Gileadensis			
Anchusa Tinctoria	Pentandria	Monogynia	Boraginaceæ
Anethum Fœniculum	Pentandria	Digynia	Umbellatæ
——— Graveolens			
Angelica Archangelica			
Anthemis Nobilis	Syngenesia	Superflua	Compositæ
——— Pyrethrum			
Arctium Lappa	Syngenesia	Æqualis	Compositæ
Arctostaphylos Uva Ursi	Decandria	Monogynia	Ericaceæ
Aristolochia Serpentaria	Gynandria	Hexandria	Aristolochiaceæ
Arnica Montana	Syngenesia	Superflua	Compositæ
Artemisia Abrotanum	Syngenesia	Superflua	Compositæ
——— Absinthium			
——— Maritima			
——— Santonica			
Arum Maculatum	Monœcia	Polyandria	Araceæ
Asarum Europæum	Dodecandria	Monogynia	Aristolochiaceæ
Aspidium Filix Mas	Cryptogamia	Filices	Filicaceæ
Astragalus Verus	Diadelphia	Decandria	Leguminosæ
Atropa Belladonna	Pentandria	Monogynia	Solanaceæ

Name.	*Class.*	*Order.*	*Natural Order.*
	Triandria	Digynia	Graminaceæ
Myrrha	Octandria	Monogynia	Burseraceæ
i	Cryptogamia	Fungi	Fungaceæ
i	Decandria	Monogynia	Burseraceæ
aanha	Pentandria	Monogynia	Cinchonaceæ
	Decandria	Monogynia	Clusiaceæ
m	Pentandria	Monogynia	Solanaceæ
nsis	Tetradynamia	Siliquosa	Brassicaceæ
	Pentandria	Digynia	Umbellatæ
maticus	Icosandria	Monogynia	Myrtaceæ
	Decandria	Monogynia	Leguminosæ
ride Cassia.			
icta	Syngenesia	Frustranea	Compositæ
chen.			
embosa	Decandria	Monogynia	Pyrolaceæ
aurium, vel			
	Pentandria	Monogynia	Gentianaceæ
olia olia gifolia	Pentandria	Monogynia	Cinchonaceæ
ira	Diœcia	Monadelphia	Menispermaceæ
a	Polyadelphia	Icosandria	Aurantiaceæ
natus, vide			
i.			
racia	Tetradynamia	Siliculosa	Brassicaceæ
	Monœcia	Hexandria	Palmaceæ
mnale	Hexandria	Trigynia	Melanthaceæ
um	Pentandria	Digynia	Umbellatæ
mmonia	Pentandria	Monogynia	Convolvulaceæ
cinalis, vel			
	Decandria	Monogynia	Amyridaceæ
lvum	Pentandria	Digynia	Umbellatæ
	Triandria	Monogynia	Iridaceæ
a	Monœcia	Monadelphia	Euphorbiaceæ
athis	Monœcia	Monadelphia	Cucurbitaceæ
	Monandria	Monogynia	Zingiberaceæ
aum	Pentandria	Digynia	Umbellatæ
fuga, vide			
yrus.			
is	Diadelphia	Decandria	Leguminosæ
m	Octandria	Monogynia	Thymeleaceæ
ium	Pentandria	Monogynia	Solanaceæ
vel Sylvestris	Pentandria	Digynia	Umbellatæ
physagria	Polyandria	Trigynia	Ranunculaceæ
phyllus	Decandria	Digynia	Silenaceæ
rea	Didynamia	Angiospermia	Scrophularia
	Pentandria	Monogynia	Rutaceæ
is	Diadelphia	Decandria	Leguminosæ
iacum	Pentandria	Monogynia	Umbellatæ
ajerva	Tetandria	Monogynia	Urticaceæ

Botanical Name.	*Class.*	*Order.*	*Natural Order.*
Erythræa, vide Chironia.			
Eryngium Maritimum	Pentandria	Digynia	Umbellatæ
Euphorbia Officinalis	Dodecandria	Trigynia	Euphorbiaceæ
Ferula Assafœtida	Pentandria	Digynia	Umbellatæ
Ficus Carica	Polygamia	Diœcia	Urticaceæ
Fœniculum Vulgare, vide Anethum			
Fucus Vesiculosus	Cryptogamia	Algæ	Algaceæ
Galbanum Officinale	Pentandria	Monogynia	Umbellatæ
Galipea Cusparia	Diandria	Monogynia	Rubiaceæ
Gentiana Lutea	Pentandria	Digynia	Gentianaceæ
Geoffrea	Diadelphia	Decandria	Leguminosæ
Geum Urbanum	Icosandria	Polygynia	Rosaceæ
Glycyrrhiza, vide Liquiritia.			
Gratiola Officinalis	Diandria	Monogynia	Scrophulariaceæ
Guaiacum Officinale	Decandria	Monogynia	Zygophyllaceæ
Hæmatoxylon Campechianum	Decandria	Monogynia	Leguminosæ
Helleborus Fœtidus	Polyandria	Polygynia	Ranunculaceæ
——— Officinalis			
Helonias Officinalis	Hexandria	Trigynia	Melanthaceæ
Heracleum Gummiferum	Pentandria	Digynia	Umbellatæ
Hordeum Distichon	Triandria	Digynia	Graminaceæ
Humulus Lupulus	Diœcia	Pentandria	Urticaceæ
Hyoscyamus Niger	Pentandria	Monogynia	Solanaceæ
Hyssopus Officinalis	Didynamia	Gymnospermia	Labiatæ
Inula Helenium	Syngenesia	Superflua	Compositæ
Ipomæa Jalapa	Pentandria	Monogynia	Convolvulaceæ
Iris Florentina	Triandria	Monogynia	Iridaceæ
Juniperus Communis	Diœcia	Monadelphia	Pinaceæ
——— Lycia			
——— Sabina			
Krameria Triandria	Tetrandria	Monogynia	Polygalaceæ
Lactuca Sativa	Syngenesia	Æqualis	Compositæ
——— Virosa			
Laurus Camphora	Enneandria	Monogynia	Lauraceæ
—— Cassia			
—— Cinnamomum			
—— Nobilis			
—— Sassafras			
Lavendula Spica	Didynamia	Gymnospermia	Labiatæ
Leontodon Taraxacum	Syngenesia	Æqualis	Compositæ
Lichen Islandicus	Cryptogamia	Lichenes	Lichenaceæ
——— Rocella			
Linum Catharticum	Pentandria	Pentagynia	Linaceæ
——— Usitatissimum			
Liquiritia Officinalis	Diadelphia	Decandria	Leguminosæ
Lobelia Inflata	Pentandria	Monogynia	Lobeliaceæ
Lythrum Salicaria	Dodecandria	Monogynia	Salicariæ
Malva Sylvestris	Monadelphia	Polyandria	Malvaceæ
Maranta Arundinacea	Monandria	Monogynia	Marantaceæ
Marrubium Vulgare	Didynamia	Gymnospermia	Labiatæ
Melaleuca Cajuputi, vel minor	Polyadelphia	Icosandria	Myrtaceæ
Melissa Officinalis	Didynamia	Gymnospermia	Labiatæ
Menispermum Palmatum	Diœcia	Dodecandria	Menispermaceæ

Botanical Name.	*Class.*	*Order.*	*Natural Order.*
Mentha Piperita	Didynamia	Gymnospermia	Labiatæ
—— Pulegium			
—— Viridis			
Menyanthes Trifoliata	Pentandria	Monogynia	Gentianaceæ
Momordica Elaterium, vel Ecbalium Officinarum	Monœcia	Monadelphia	Cucurbitaceæ
Morus Nigra	Monœcia	Tetrandria	Urticaceæ
Mucuna Pruriens	Diadelphia	Decandria	Leguminosæ
Myristica Moschata	Diœcia	Monadelphia	Myristicaceæ
Myroxylon Peruiferum	Decandria	Monogynia	Amyridaceæ
Myrtus Pimenta	Icosandria	Monogynia	Myrtaceæ
Nicotiana Tabacum	Pentandria	Monogynia	Solanaceæ
Olea Europea	Diandria	Monogynia	Oleaceæ
Origanum Marjorana	Didynamia	Gymnospermia	Labiatæ
—— Vulgare			
Ornus Europæa	Diandria	Monogynia	Oleaceæ
Oxalis Acetosella	Decandria	Pentagynia	Oxalidaceæ
Papaver Rhœas	Polyandria	Monogynia	Papaveraceæ
—— Somniferum			
Pastinaca Opopanax	Pentandria	Digynia	Umbellatæ
Pimpinella Anisum	Pentandria	Digynia	Umbellatæ
Pinus Abies	Monœcia	Monadelphia	Pinaceæ
—— Balsamea			
—— Larix			
—— Sylvestris			
Piper Cubeba	Diandria	Trigynia	Piperaceæ
—— Longum			
—— Nigrum			
Pistacia Lentiscus	Diœcia	Pentandria	Anacardiaceæ
—— Terebinthus			
Polygala Senega	Diadelphia	Octandria	Polygalaceæ
Polygonum Bistorta	Octandria	Trigynia	Polygonaceæ
Potentilla Tormentilla	Icosandria	Polygynia	Rosaceæ
Prunus Domestica	Icosandria	Monogynia	Amygdaleæ
Pterocarpus Erinaceus	Diadelphia	Decandria	Leguminosæ
—— Santalinus			
Punica Granatum	Icosandria	Monogynia	Myrtaceæ
Pyrus Cydonia	Icosandria	Pentagynia	Pomaceæ
Quassia Excelsa	Decandria	Monogynia	Simarubaceæ
—— Simarouba			
Quercus Infectoria	Monœcia	Polyandria	Corylaceæ
—— Pedunculata			
—— Robur			
Rhamnus Catharticus	Pentandria	Monogynia	Rhamnaceæ
Rheum Palmatum	Enneandria	Trigynia	Polygonaceæ
—— Undulatum			
Rhododendron	Decandria	Monogynia	Rhododendræ
Rhus Toxicodendron	Pentandria	Trigynia	Anacardiaceæ
Ricinis Communis	Monœcia	Monadelphia	Euphorbiaceæ
Roccella, vide Lichen.			
Rosa Canina	Icosandria	Polygynia	Rosaceæ
—— Centifolia			
—— Gallica			
Rosmarinus Officinalis	Diandria	Monogynia	Labiatæ
Rubia Tinctorum	Tetrandria	Monogynia	Rubiaciæ

Botanical Name.	*Class.*	*Order.*	*Natural Order.*
Rumex Acetosa	Hexandria	Digynia	Polygonaceæ
——— Aquaticus			
Ruta Graveolens	Decandria	Monogynia	Rutaceæ
Saccharum Officinarum	Triandria	Digynia	Graminaceæ
Sagus Rumphii	Monœcia	Hexandria	Palmaceæ
Salix Alba	Diœcia	Diandria	Salicaceæ
—— Caprea			
—— Fragilis			
Salvia Officinalis	Diandria	Monogynia	Labiatæ
Sambucus Nigra	Pentandria	Trigynia	Caprifoliaceæ
Scilla Maritima	Hexandria	Monogynia	Liliaceæ
Scrophularia Nodosa	Didynamia	Angiospermia	Scrophulariaceæ
Secale Cereale	Triandria	Digynia	Graminaceæ
Simaruba Officinalis	Decandria	Monogynia	Simarubaceæ
Sinapis Alba	Tetradynamia	Siliquosa	Brassicaceæ
——— Nigra			
Sium Nodiflorum	Pentandria	Digynia	Umbellatæ
Smilax Officinalis	Diœcia	Hexandria	Smilaceæ
Solanum Dulcamara	Pentandria	Monogynia	Solanaceæ
————Tuberosum			
————Nigrum			
Solidago Virgaurea	Syngenesia	Superflua	Compositæ
Spartium Scoparium	Diadelphia	Decandria	Leguminosæ
Spigelia Marilandica	Pentandria	Monogynia	Spigeliaceæ
Stalagmitis Cambogioides	Polygamia	Monœcia	Guttiferæ
Strychnos Nux Vomica	Pentandria	Monogynia	Apocynaceæ
Styrax Benzoinum	Decandria	Monogynia	Styraceæ
——— Officinale			
Swietenia	Decandria	Monogynia	Clusiaceæ
Tamarindus Indica	Monadelphia	Triandria	Leguminosæ
Tanacetum Vulgare	Syngenesia	Superflua	Compositæ
Teucrium Marum	Didynamia	Gymnospermia	Labiatæ
———— Chamædrys			
Tormentilla Erecta	Icosandria	Polygnia	Rosaceæ
Triticum Hybernum	Triandria	Digynia	Graminaceæ
Tussilago Farfara	Syngenesia	Superflua	Compositæ
Ulmus Campestris	Pentandria	Digynia	Ulmaceæ
Valeriana Officinalis	Triandria	Monogynia	Valeraniaceæ
Veratrum Album	Polygamia	Monœcia	Melanthaceæ
Veronica Beccabunga	Diandria	Monogynia	Scrophulariaceæ
Viola Odorata	Pentandria	Monogynia	Violaceæ
Vitis Vinifera	Pentandria	Monogynia	Vitaceæ
Wintera Aromatica	Polyandria	Tetragynia	Winteraceæ
Zingiber Officinale	Monandria	Monogynia	Zingiberaceæ.

CHEMICAL NOTES.

CHEMISTRY is a science which investigates and teaches the qualities of bodies, both in a simple and compound state.

The earth and its inhabitants, with the natural objects surrounding us, are compounds of a small number of simple bodies or elements, in very variable proportions, which are kept in a state of combination by peculiar forces, called affinities or attractions. These attractions are of three kinds, named attraction of aggregation or cohesion, chemical attraction or affinity, and attraction of gravitation.

Attraction of *cohesion* is a force exerted between similar particles at insensible distances (that is, such as have uniform properties), and only gives increase to the bulk of the substance.

By this power, bodies may be liquid, solid, or aeriform, according to the force of the cohesion keeping them together. The most beautiful illustration of this attraction is seen in crystallization.

Particles of bodies are spoken of as *integrant*, *component*, and *elementary*.

The integrant particles are any small portions of a large substance, such as a lump of chalk. If this be minutely divided, every particle of it is still carbonate of lime, and is named an integrant particle.

This particle of chalk, by analysis, is found to consist of carbonic acid and lime, each of which is named a constituent or component particle, or proximate principle.

Carbonic acid and lime are also compounds, the former of carbon and oxygen, the latter of oxygen and calcium; and the bodies thus separated are named elementary particles, or ultimate elements.

Chemical attraction, or affinity, acts by uniting bodies, or particles of a dissimilar nature at insensible distances; and, by the union of two, forming a compound, frequently not possessing a single property of either of its components.

There are numerous modifications of this affinity, of which the following are the most prominent:

Affinity does not exist in the same degree in all bodies in respect to each other, but has always an individual preference. This has been called elective affinity, because bodies appear constantly to select those for which they have the greatest attraction. Thus, if sulphuret of mercury and iron filings are mixed and heated together, the sulphur quits the mercury and combines with the iron, and the mercury is set free in its simple state.

A second difference is found to depend upon the relative quantities of bodies which act upon each other; thus, a body possessing less affinity than another, but existing in larger quantity, may overcome the attraction of the more powerful one, or, in other words, quantity may sometimes overbalance affinity.

The different degree of cohesion of several bodies is another source of modification; thus, the tendency to assume the aeriform state may overcome the disposition to combination, even when the elements disposed to unite are present in large quantities.

A fourth modification of chemical affinity is exhibited when two compound bodies, by mixing, act upon each other, and produce an interchange of elements; as, when the sulphate of magnesia and carbonate of potash are brought in contact, there is an exchange of acids, and sulphate of potash with carbonate of magnesia are the products: this kind of action is called double elective affinity, or attraction.

The causes of these changes are not thoroughly agreed upon, but probably they depend, in a great degree, on the opposite electrical states of elementary atoms.

Attraction of gravitation is that force which all bodies mutually exert on each other at a distance. The example most familiar to us is the falling of a body towards the earth's surface; this tendency is also shown when a body is raised from that surface, and produces the effect which we call weight.

This is but a particular case of the universal attraction; for, by the investigation of mathematicians and astronomers, it has been discovered that all the heavenly bodies exert a mutual action of this kind on each other.

Material substances not only possess chemical, but also physical properties, which are of two kinds, general and secondary.

The general properties are—

Extensibility; impenetrability; mobility; divisibility; gravitation; porosity; indestructibility.

Extensibility implies the occupation of space, in reference to length, breadth, and thickness.

Impenetrability means that two particles of a body cannot be made to occupy the place of one at the same time.

Divisibility, to an extreme degree, is known to exist, and supposed by some to have no limits; at all events, as far as our present means and senses can ascertain. By supposing a limit to the divisibility, we are naturally led to the atomic theory, which will be subsequently noticed.

Porosity implies that bodies consist of particles, between which spaces exist, as all of them admit of reduction of bulk by diminished temperature or mechanical action; and, as matter is incompressible, reduction of size would be impossible without porosity; and this property of matter necessarily results from the atomic hypothesis.

Indestructibility.—Bodies may be decomposed, and apparently dissipated and lost to sight, but are not lost to existence. They only pass into new forms and combinations, and still retain the general qualities of matter. This is impenetrability, expressed in another form.

The secondary properties of matter are—

Opacity; transparency; elasticity; softness; hardness; colour; density; fluidity; solidity.

Most of the above terms are sufficiently clear, as to require little explanation.

By *Elasticity* we understand that the particles of a body may be separated or driven closer to each other by some force, and return immediately to their former situation as soon as that force is withdrawn. Thus, a gas may be compressed into a less space, but will immediately expand to its former bulk as soon as the pressure is removed. A piece of Indian rubber admits of being elongated by force, which being withdrawn, allows it to regain its former shape and dimensions.

Density, *solidity*, *hardness*, and *fluidity*, refer to the consistence of bodies, and will depend upon the number of particles and the distance between them. In solids the particles are most numerous, and the spaces between them are imperceptible; the different cohesion between them will produce varied degrees of hardness. There is in bodies a power opposed to cohesion, named repulsion, which is less in solid than in liquid or gaseous bodies.

Liquids are fluids, of which the upper surface of the retaining vessel may be open or free; but gases are fluids which require a closed vessel to retain them.

When liquids are retained in a vessel, the upper surface is horizontal; thus the surface of small lakes may be called horizontal; but in any large expanse of water the surface will be like the ocean, sensibly curved.

Where a liquid, in small quantity, is kept in close space, it is found to disappear under a proper temperature. If we reduce the temperature, or increase the pressure sufficiently, the liquid will again reappear. In its former or invisible state, it is said to be vapour; and the quantity present in any space will depend on the pressure and temperature.

From the fact of the condensation of the gases, discovered by Mr. Faraday, it is concluded that the fluids, designated by the term *permanent gases*, are the vapours of liquids, which can only exist as such, under low temperatures, or high pressures, or both conjointly.

Inertia is that property by which matter is rendered incapable of altering its state, whether of rest or of motion. Hence, when a body at rest changes its state to one of motion, this can only be in virtue of some extraneous force; all bodies are capable of being put in motion. This is commonly known as mobility.

DIVISION OF BODIES.

Most animal, vegetable, and mineral substances, may be decomposed and resolved into what are called proximate principles, such as albumen, gelatin, tannin, gallic acid, oxides, &c.; and these again can be resolved into separate and distinct substances, which admit of no further decomposition, and are therefore called ultimate elements. Cinnabar, or sulphuret of mercury, may be resolved into sulphur and mercury, which, by our present knowledge of chemistry, are incapable of further decomposition.

In tables of simple bodies are found a number of substances which want many of the principal qualities of the others; on which account it is doubtful whether they should be classed amongst material substances. Many consider them as only qualities of bodies to be found in them under certain circumstances.

The chief difference between them and other bodies is, that they are imponderable.

They are three in number, viz., light, heat, and electricity; but as these are intimately connected with each other in many points of view, it is far from improbable that they are only degrees or modifications of one universal principle.

SIMPLE IMPONDERABLE BODIES.

LIGHT.

The sun is the great source of light and heat, which are constantly emanating from it, and constitute what we call the solar rays.

Light travels with such rapidity, that it occupies about eight minutes in reaching the earth from the sun, a distance of 95 millions of miles, at the rate of 195,000 miles in a second. It moves in straight lines, but at the same time becomes attenuated, so that the intensity of light diminishes in an inverse ratio of the square of the distance from the sun.

When the solar rays fall on a body, they become reflected from its surface, and render it visible. The angle at which they are reflected is equal to the angle of incidence.

Some bodies allow these rays to pass through them without alteration, and are hence called conductors of light; but, in common terms, are said to be transparent or diaphanous.

The solar rays, in penetrating the interior of transparent bodies, deviate from the straight line, and undergo different inflexions, according to their density, combustibility, or condition of their surface.

If the rays pass from a rare into a dense medium, as from the air into water, they approach to the perpendicular at their points of immersion; but if they pass from a dense to a rare medium, they are turned from the perpendicular. This deviation from the original direction is called refraction. On this principle is explained the familiar experiment of putting a piece of money into a basin, and stepping back, that the edge just conceals it from sight; if water be poured into the vessel, the money agains becomes visible.

Density is not alone concerned in producing refrangibility of the rays: combustible bodies possess this property in the most powerful degree, as the diamond, hydrogen gas, naphtha, &c.

Decomposition of the Solar Rays.

When the solar rays are made to enter a dark chamber by a small aperture, and they are received upon a glass prism, behind which is white paper spread out at a certain distance, an elongated figure, composed of a number of colours, is obtained, called the solar spectrum. The colours seen in it are red, orange, yellow, green, blue, indigo, and violet.

These colours gradually merge one into the other, so that in fact there are not seven only, but an infinite number of colours, passing from the extreme red to the extreme violet.

These rays differ from each other in certain respects; thus, the greatest heat is found to be produced in the red, and to decrease progressively down to the violet. For, if the rays are made to fall upon a flat surface, and a thermometer be placed in each, it is found that the mercury rises highest in the red rays.

Non-luminous calorific rays exist, beyond the red, and seem to produce a still more powerful effect upon the thermometer; but the fact is, the place of maximum heat depends on the nature of the refracting prism.

This phenomenon proves that the solar rays, by passing through the prism, are separated into calorific and colorific. The decomposition of white light arises from the unequal refrangibility of the colorific rays.

The violet end of the spectrum is ascertained to be greatly concerned in acting chemically upon bodies. If chloride of silver, which is of a beautiful white colour, be exposed to the violet rays, it speedily becomes black; whereas in the other end of the spectrum it undergoes no change. Some consider that the violet rays produce the oxidation of metals, and that the red rays serve to promote their reduction to the metallic state.

The colours of bodies are owing to a decomposition of the solar rays, their surface reflecting certain rays, but absorbing or retaining the rest. Thus, a red substance reflects the red rays and absorbs all the others. The infinite variety in the combinations of the reflected rays gives rise to the surprising diversity of colours.

Black objects absorb all the rays, reflecting none. White objects reflect all the rays, and absorb none.

To show that white bodies reflect all the rays, a pretty experiment has been instituted. If a piece of paper be painted in compartments with the seven prismatic colours, and then rotated rapidly, it assumes a white appearance.

Opaque bodies, which absorb light, become heated; hence it is warmer on land than on the sea.

From a knowledge of this fact, instruments have been employed to ascertain the quantity of light. For this purpose two thermometers are employed, of which the tube of one is to be blackened. If both are exposed to light, the mercury rises highest in the black one, and its elevation in a given time indicates how much the rays have been decomposed in producing that temperature.

The instrument employed to measure the intensity of light is called a photometer. By its assistance Leslie has calculated that the intensity of solar light is 12,000 times greater than that of a candle; that is to say, a portion of sun, of the size of the flame of a candle, would give as much light as 12,000 candles.

Combustion affords rays very like those emanating from the sun, but infinitely less dense, and less intimately combined with the heat which they contain. This is readily ascertained by standing before a bright fire in the winter, when heat is felt at a considerable distance, although the air of the room is not heated; again, ice on the windows may be melted by the rays, whilst water placed in the shade, between them and the fire, freezes.

It is found that luminous rays can exist without the accompaniment of any sensible heat, as in the rays passing through a lens, and as is observed in the light from the moon, which seems to have absorbed all the heat, and reflects light deprived of its heating property. Many bodies, as some living animals, and vegetables during putrefaction, also some minerals, &c., give out light, without combustion. The source of such light is quite unintelligible.

Luminous rays exert a considerable influence upon the composition of bodies. The most general effect is, to reduce oxidized bodies to their primitive simple state, by setting free the oxygen. This is seen in nitric acid, which by exposure to light loses part of its oxygen, and is reduced to nitrous acid.

Light also renders pale and destroys vegetable colours, as we often observe when silks or stuffs are exposed to its influence. Many have thought that this depends on its heating properties, for many colours which resist the light for some time, if heated beyond the temperature of boiling water, have become pale in some minutes.

Light is useful, and indeed necessary, to vegetable and animal life. In the former it operates by decomposing its carbonic acid, fixing the carbon, and setting the oxygen free.

There are two theories of the nature of light, named *corpuscular* and *undulatory*. The former was advocated by Newton, who supposed that light was a very subtile matter, which, like heat, entered into bodies; and in the eye, actually come in contact with the retina.

Dr. Young supported the undulatory theory, which is generally received at the present time. This supposes that the universe is pervaded by a very subtile ether or fluid, which penetrates into the most dense substances; and that light, by striking against its particles, throws them into motion, which is imparted from one to the other, like tremors of the air causing sound, and producing colours, varying with the length of the luminous wave, the intensity of which depends on the rapidity of the impulse.

Still it is impossible to demonstrate what light is, whether it is a separate substance, or a combination of chemical rays. When it is absorbed by opaque bodies it totally disappears, and such bodies exposed to it for years receive no increase in weight; nor does the sun suffer the least apparent diminution in its illuminating power, after diffusing its rays during so many ages.

CALORIC.

Caloric is the word usually employed in chemistry to denote that substance or quality which is commonly called heat. We are acquainted with it in two states, which are named *latent* and *free*. To the former condition some restrict the term caloric, to the latter that of heat. It is the most active agent in nature, and exists in all bodies in various proportions, being least in solids, in the greatest quantity in gases, and in an intermediate degree in liquids.

Free or uncombined caloric constitutes temperature, the degree of which is ascertained by its effects on bodies, causing expansion or increase of their volume. This expansion is attended likewise by change of form; thus, by its means, solids are converted into liquids, and liquids into vapours, the degree of dilatation increasing with the temperature. The expansion of solids may be illustrated by taking a metallic rod, which in the cold state will pass through a ring exactly fitted to it: if the rod be heated, it is found that it will no longer pass through the ring, but on becoming cold, it will resume its normal dimensions.

The expansion of fluids may be seen, by taking a common thermometer and applying heat to the bulb, when the mercury will rise in the tube, and occupy an increased space. The expansion of gases may be readily proved, by filling a bladder with common air, and placing it near the fire; the heat, by expanding the gas, causes the bladder to burst.

Solids and liquids are found to expand in unequal ratios; solids expanding least, liquids more, gases most. Gases have been discovered to expand in an equal ratio in respect to each other, in the proportion of $\frac{1}{480}$th of their volume for every degree of Fahrenheit, commencing at 32 degrees: so that a gas must be heated to about 500 degrees to have its volume doubled, or 480 degrees higher than any other given point. Vapours obey the same law, until they are cooled down nearly to their point of condensation. All bodies, by being expanded, become of lighter specific gravity. On the principle of expansion by heat, we explain the breaking of glasses by pouring hot water into them, especially in winter. The glass being a bad conductor of heat, the inner particles expand before the outer ones can be affected; a separation of them consequently takes place. Expansion by heat is observed to affect the rate of going of clocks, by producing an elongation of the pendulum, and the vibrations being necessarily fewer. Thus, clocks are found to lose in summer and to gain in winter.

The quantity of heat which is set free in any situation is ascertained by an instrument called a thermometer, which may be defined to be a measurer of heat or expansion, that is, the quantity of free caloric is judged of by the increase of volume given to fluids contained in this instrument. The liquids employed in thermometers are mercury, alcohol, and air. The latter is most delicate, and most easily affected. Alcohol is used to ascertain very low temperatures, because there is no satisfactory account of its ever having been frozen. Mercury is preferable for moderate temperatures, remaining liquid in a more extensive range of temperature than any other fluid, and expanding with a greater degree of regularity.

A thermometer is made with a glass tube, having a bore through it of equal diameter. One end is then to be melted, and air blown in from the cool end, to form a bulb. The bulb and tube are then heated to expel the air, and in that state the open end is introduced into mercury: on cooling, the mercury is found to have ascended in the tube and the bulb. This heating and immersion in mercury is repeated until the bulb is filled, and the mercury extends a third or half-way up the tube. Heat is again applied to expand the mercury and drive out all the air, and when the mercury has reached the top, a flame is directed upon the open end of the tube by means of a blowpipe, until the glass melts and the orifice is closed, or, in other words, it is hermetically sealed. The next stage in the process is to graduate it. This is done by immersing the bulb in water, formed during the melting of ice or snow, the temperature of which is taken as 32 degrees, and in Fahrenheit's scale is called the freezing-point of water; a scratch is then made at the point to which the mercury descends. The bulb is subsequently to be immersed in boiling water, to the depth of about two inches, and another scratch made on the tube at the point to which the mercury ascends. This is termed the boiling-point. The intermediate space is to be equally divided into 180 degrees, thus making the boiling-point 212 degrees. The zero point of Fahrenheit's thermometer is 32 degrees below the freezing-point, because Fahrenheit imagined that no greater degree of cold existed, or could be produced. In the Centigrade scale the freezing-point of water is taken as zero, and the boiling-point 100; in the scale of Reaumur the zero is taken as the freezing-point of water, and 80 as the boiling point.

The particular degrees marked on Fahrenheit's thermometer are the following:

Boiling point (of water)	212
Spirit boils	176
Fever heat	110
Blood heat	98
Summer heat	76
Temperate heat	55
Freezing point (of water)	32
Zero	0

On the Continent, degrees of heat are designated according to the Centigrade or Reaumur's thermometer, therefore students are called upon in their studies to reduce the various scales to each other.

The scales of Reaumur and Centigrade both commence at the freezing point of water, which they make their zero, whilst that of Fahrenheit commences from a hypothetical zero, 32 degrees below the freezing point, which zero is obtained by a mixture of snow and salt.

Between the freezing and boiling points—

Fahrenheit has	180 degrees
Centigrade	100 „
Reaumur	80 „

Thus, the boiling point of Fahrenheit is 212 degrees, whilst those of the others are respectively 100 and 80.

To reduce the degrees of Centigrade to those of Reaumur it is necessary to divide by five and multiply by four, thus:

5)100 = Boiling point of Centigrade.
20
4
80 = Boiling point of Reaumur;

and *vice versâ* for the alteration of the degrees of Reaumur into those of Centigrade.

The reduction of the degrees of Fahrenheit into those of Reaumur is somewhat more difficult, for the 32 degrees of Fahrenheit below the freezing point have first to be deducted, and after that the remaining degrees have to be divided by nine and multiplied by five for the Centigrade, or by four for the Reaumur scale, thus:

212 = Boiling point of Fahrenheit
Deduct, 32
9)180
20
5
100 = Boiling point of Centigrade.

To bring the degrees of Reaumur and Centigrade to those of Fahrenheit, it is necessary to divide by four or five, as the case may be, and then to multiply by nine and add thirty-two, thus:

4)80 = Degrees of Reaumur.
20
9
180
32
are equal to 212 degrees of Fahrenheit.

The reason that we use the numbers 4, 5, and 9 in these calculations is, that that is the relative proportion which the scales bear to one another when divided by 20.

High temperatures are ascertained by instruments called pyrometers, amongst which that of Mr. Daniell is by far the most in use.

Wedgwood's pyrometer consisted of a metallic groove, in which was introduced a quantity of a particular species of clay. By the application of heat the water was expelled, the clay passed into a state of fusion, and contracted in proportion to the elevation of temperature.

The highest temperature supposed to have been ascertained was about 32,000. Some experiments give the greatest heat as about 24,000. Professor Daniell considered that these calculations were far too high, and made the greatest heat of his scale not to exceed 4000.

Heat is conveyed or passed from one body to another, by radiation, conduction, and convection. By *convection* is understood the mode in which the water becomes heated in a kettle placed upon a fire; thus the particles at the bottom, by contact become hotter than the rest, and consequently lighter and rise to the surface, and in rising give no heat to those they come in contact with in their passage: the heavier cold particles descend, so that whilst the water is heated, and even during boiling, there is an ascending and descending current.

In the summer time, and in fact at all seasons, the atmosphere is heated almost exclusively by convection.

By the *conduction* of heat is understood the power by which heat passes from particle to particle, until they have all attained the same temperature; and, according as the particles transmit, receive, or part with their heat with more or less rapidity, they are called good or bad conductors.

The best conductors are the metals, and most bodies possessing much density.

Amongst the bad conductors are gases, water, silk, wool, down, fur, charcoal, glass, &c.

Radiation is that property by means of which heat is evolved, or flies off from bodies in straight lines, like light, in every direction. This is presumed to occur at all temperatures; but heated bodies near colder ones radiate more than they receive, as there is always a tendency to obtain an equilibrium.

Bodies part with their heat by radiation with unequal degrees of rapidity.

Those bodies which reflect heat best are the worst radiators, and *vice versâ*, so that all good reflectors of heat, as well as of light, must have a clean, bright, polished surface.

The best radiators of caloric are bodies having a dark and rough surface. Those of a light colour, smooth, and polished, part with their heat less speedily, and are called bad radiators. This may be illustrated by taking a square vessel, with the sides presenting different surfaces, that is, one rough and black, another polished, another white, and a fourth of some dark colour.

If hot water be poured into this vessel, and a thermometer is placed at an equal distance opposite each surface, the fluid in the thermometer opposite the black one will be found to rise highest, that opposite the polished surface will be least affected.

There is an illustration of the same fact, even in making tea. If a silver polished teapot is used, the water will retain its heat longer, and extract more of the soluble matter by a single infusion; on the other hand, if a black and rough teapot be used, the tea will be weaker; but to persons who take numerous cups, and make several infusions on the same leaves, the black teapot is found preferable, as the last cup is almost as good as the first.

The formation of dew is explicable on the principle of the radiation of caloric. During fine and cloudless weather, after sunset, the earth, radiating its caloric, and receiving none in return, becomes colder than the surrounding medium. The watery vapour held in solution and suspension in the atmosphere, by coming in contact with the cold surface, is condensed upon it. If there be clouds, the heat radiated from the earth is returned to it again, so that there is little reduction in temperature, and consequently little condensation of the watery vapour.

The snow affords a great protection to vegetation by preventing radiation, that is, preserving the earth from any great diminution of its temperature.

If a similar quantity of two bodies be exposed to a given temperature, it is found that they vary in the time required to reach that temperature, also in the time they take to cool, and in the quantity of heat evolved whilst that change is taking place. Thus, water requires twenty-three times as much heat to raise it to a given point as mercury. The heat which thus enters the body is called *specific* heat.

The fact is shown by the *calorimeter,* an instrument containing a frame or cage of ice, in which a certain quantity of ice or snow is introduced. To this the heated body is added, and the relative quantity of ice or snow melted by the substance whilst cooling, is considered to prove the difference of the quantity of heat absorbed.

The solid is considered to be the natural state of bodies, which become liquids, or vapours, according to the quantity of caloric combined with them. Liquefaction is one of the forms of expansion which is ordinarily accomplished by heat; still the conversion of a solid into a fluid is attended with a disappearance of caloric, or, in other terms, the production of cold. The substance is said to have acquired an increased capacity for caloric.

This increased capacity for caloric is the cause of cold being experienced on the tops of mountains, and when an ascent is made in a balloon. The higher a person rises, the colder he feels, from the circumstance of the capacity of the air for heat increasing, and the heat being abstracted from the body. The ratio in which temperature diminishes, is estimated at one degree for every 350 feet. This explains why lofty mountains are covered with perpetual snow and ice.

The heat, which becomes latent during the conversion of a solid into a liquid, is called the *caloric of fluidity,* or latent heat of the liquid.

The *latent* heat of water is estimated at 140 degrees, of which fact the following is an illustration. If a pound of ice at 32 degrees be mixed with a pound of water at 172, the ice will be melted; but the temperature of the mixture will be only 32. The reason of it is this: during the melting of the ice, 140 degrees of free heat enter between the particles of the ice, making it liquid, the heat itself becoming latent. But if a pound of water at 32 be mixed with a pound of water at 172, the temperature of the mixture will be intermediate, that is, 102.

Liquids would be constantly and rapidly converted into vapours, if there were not some power to resist such a change. This power, under ordinary circumstances, is the pressure of the atmosphere. This pressure is considered as equal to nearly 15 pounds upon every square inch, but is liable to variation at different times and at different elevations. The pressure of the atmosphere is estimated by the barometer. This instrument is constructed upon the principle, that the atmospheric pressure can support a certain column of mercury or of water: the column of mercury is 30 inches at the level of the sea, the column of water 34 feet. In proportion as we ascend in the atmosphere, or the more we become elevated above the level of the sea, the less becomes the pressure, and the smaller is the column of the mercury which can be supported. The difference which is made in such cases is found to be about one inch in the column of mercury for every 830 feet.

If the pressure upon the liquids be diminished, they evaporate more speedily, and more easily are made to boil: some liquids may be made to boil at the freezing point of mercury, if the atmospheric pressure be taken off them. Ether boils in vacuo at about 40 below zero. Liquids in general boil at 140 degrees lower, in vacuo, than under the pressure of the atmosphere; thus water in vacuo boils at 72.

The boiling-point of water diminishes as we ascend a mountain, in the ratio of one degree for every 350 feet in elevation. Water boils at Mexico below 200, and at the top of Mount Blanc at 186. On the contrary, if we could descend much below the surface of the earth, the boiling-point of fluids would be found to be much increased.

The sources of heat are considered to be six. They are: the sun's rays, combustion, mechanical action, electricity, chemical action, and animal heat.

The *sun's rays* are composed of light and heat, which are separated when they reach the surface of the earth. The heat thus set free produces varieties of temperature on different parts of the globe. The average heat is estimated at 50, highest 120, the lowest about 50 degrees below zero.

Combustion, in the ordinary acceptation of the term, is the rapid union of oxygen with a combustible body, attended with an evolution of light and heat.

Mechanical action includes friction and percussion, by which intense heat is evolved. Of this there are numerous illustrations, as, by rubbing pieces of wood together, ropes and pulleys, axletrees of carriages, and even forests, are set on fire by the branches of trees rubbing together.

Heat is considered to be chemically evolved during the fermentations, and when fluids by admixture become condensed. On the principle of fermentation is explained the spontaneous combustion of hay-stacks; and by the force of condensation is produced the combustion which sometimes takes place when tow and cotton, moistened with linseed oil, are exposed to the atmosphere.

By *animal heat* is understood the temperature of the body, which is supported by the action of the vital functions. The changes in the blood, by combustion of the tissues and by respiration, are imagined to be the chief causes of the evolution of heat.

Cold was supposed, at one time, to be a positive body, like heat, but is now considered to be only negative, or, in other words, the absence of caloric. It is always produced by rarefaction, that is, when a body is converted from a dense to a rarer state.

Thus ether or spirit placed upon the hand passes into vapour, or a rarefied state, acquiring an increased capacity for caloric; free caloric is absorbed from the hand, and cold is experienced.

When snow and salt are mixed together, they pass into a liquid or rarefied state, and heat is abstracted from any contiguous body. On this principle, cold is always generated by freezing mixtures. There are several experiments with the air-pump, to show the freezing of water at ordinary temperature.

If a little cup of water and another of ether be put into the air-pump, and the air be withdrawn, the removal of atmospheric pressure will cause the ether to boil and vaporize; its vapour, acquiring an increased capacity for heat, abstracts free caloric from the water, which, by losing its heat, freezes. The water may be made to freeze without the presence of ether, by substituting some sulphuric acid, or something that has a great attraction for water. By exhausting the air, part of the water will rise into vapour, and, from its rarefied state, will absorb sufficient heat from the water in the vessel to cause it to pass into a solid. The sulphuric acid is intended to absorb the vaporized water.

ELECTRICITY.

Electricity is the name of a science which teaches the laws, properties, and phenomena of an imponderable agent, called the electric fluid.

If a piece of sealing-wax be rubbed upon the coat-sleeve, it will be found to attract light bodies, such as small pieces of paper, and is said to be electrified; and particles thus attracted will afterwards fly off actively from it, by a property called electric repulsion.

There are two theories of the nature of the electric fluid, some contending that it is of one quality only, as proposed by Franklin; others, with Dufay, that it is of two kinds, which are called positive or vitreous, and negative or resinous. According to the former, it is imagined that bodies containing plus are always disposed to part with some to those containing minus; and, according to the theory of the two fluids, bodies oppositely electrified attract, but those similarly electrified repel each other. The principal objection to the idea of Franklin, is created by the circumstance of the negative electricity being able to *induce* the positive, and *vice versâ*. The opinion of Dufay is therefore generally adopted.

Electricity passes rapidly from an electrified body to one which is not electrified; and of those which thus receive it, some, if held in the hand, will exhibit electrical excitement, others will not: those which exhibit this excitement are called bad conductors; the others, conducting rapidly, transmit the electric fluid so completely, that they have no remaining trace of it. The best conductors are the metals (almost in the same ratio as their conducting power of heat), plumbago, charcoal, water animals and plants, and most moist substances. The bad conductors are dry gases, glass, sulphur, resin, hair, silk, and wool, with many others.

Electricity is collected upon metallic substances by insulating them, that is, cutting off, by a non-conductor, their contact with the earth, which is the great absorber of electric fluid. For this purpose glass is used, covered with a coating of resin or shell-lac, either as a handle or stand to a prime conductor, or as feet to a stool.

The electricity collected by rubbing a piece of glass with cloth appears to differ from that evolved by rubbing a piece of sealing-wax, on which account the terms vitreous and resinous electricity are used; for if two substances of the same kind be electrified from the glass, or from wax, they will repel each other; but if one be electrified from the wax, it will be attracted to the other electrified from the glass. The terms negative and positive have superseded vitreous and resinous, as the quality of the electricity depends more upon the rubber than on the glass or the resin.

A thread, in a known electrical state, is used as a test of the quality of the electricity in another body. The cat's back is said to be positive to all known substances, and glass stands next to it in order.

Sealing-wax is negative to most light substances, but to the metals it is a positive electric.

All metals contain electricity in a latent or quiescent state, that is, the two fluids are supposed to be in a state of neutralization. When electricity is evolved, the balance is disturbed, or a separation of the fluids is supposed to take place. This separation is accomplished in various ways—as by friction, change of temperature, form, contact, chemical action, &c.

When two substances, if conductors and insulated, are rubbed together, each containing positive and negative electricity, it is supposed that the fluids are separated, and that all positive electricity collects in one, and negative in the other. If, however, the substances thus rubbed be either both non-conductors, or one a non-conductor, the electric action is not manifested when they are kept in contact, and only when such bodies are separated.

A copious supply of electric fluids is obtained by the aid of the electrical machine, which consists of a cylinder or plate of glass, with a rubber, the latter made with leather stuffed with horse-hair or wool, and coated with some amalgam. The cylinder or plate revolves on an axis, and is raised from the ground by wooden pillars, or a support; a prime conductor is necessary, consisting of a smooth metallic cylinder, supported and insulated by means of a glass pedestal.

By causing the cylinder to revolve against the rubber electricity is disengaged from the glass, the rubber and the amalgam; positive electricity is collected in the prime conductor, and negative electricity is accumulated in the rubber, or any insulated conductor in contact with it. To ensure a succession of supplies it is necessary that either the rubber or the prime conductor should have communication with the earth.

Alteration of temperature in mineral substances is, in many cases, attended with manifestations of electrical excitement, but in no very remarkable degree.

Chemical action is a very abundant source of electricity, and to the latter, perhaps, we may attribute all chemical combinations. It is noticed that during combustion the burning body and parts surrounding are in oppositely electrified states, the burning body is negatively and surrounding bodies positively electrified. The electricity given off from the electrical machine is in a great measure owing to the chemical action, or oxidation, of the amalgam, for if metals be used not easily oxidized, very little electricity is disengaged. If an electrified body be made to approach an insulated non-electrified conductor, this latter becomes electrified, and, as it is said, by induction the surface nearest to the electrified body becomes dissimilarly, and that portion of the surface more remote similarly, electrified. Thus if a body positive electrified approaches another, it will cause it to exhibit negative electricity opposite to it, and in consequence of this the two attract each other. Clouds containing either positive or negative electricity, by coming near the earth, cause an accumulation of the opposite fluid on the earth's surface, and by their mutual attraction and combination produce lightning with its ravages.

A Leyden jar consists of a glass bottle coated internally and externally within a few inches of its neck with tin-foil, or any other conductor. Insulate this jar and connect its internal coating with an electric source, supposed positive, for the sake of illustration. The coating is now positively electrified by contact: in virtue of the law of induction the surface of the external coating nearest the glass becomes negatively, the other external surface positively electrified, as may be shown by approaching the finger, when for every spark passed into the jar we shall have a corresponding spark from the external coating: destroy this free positive electricity by connecting the coating with the earth, then we shall find that the external coating exerts no longer any electrical action, and the negative electricity above alluded to is said to be dissimilated by the positive of the internal coating; and keeping the outside coating in contact with the earth, and continuing to connect the inner coating with the source, the jar is, as it is said to be, charged. Now, if we connect the two coatings by means of a conductor, their electric state will instantly disappear with the evolution of light and heat, and a smart noise proportioned to the extent of the surface of the jar.

Many instruments have been invented to ascertain the quantity and quality of the electric fluid in a body: they are named electrometers and electroscopes. The most delicate is called the gold leaf electrometer. It is formed by two sheets of gold leaf, being suspended in a bell jar side by side. The least electrical excitement will cause them to diverge most powerfully.

The electric and galvanic fluids are identical, although differing in their mode of separation and disengagement from bodies, in some of their effects, tension, &c. The intensity of the electric fluid is much greater than that from galvanism, as we see by its powerful attractive and repulsive qualities, and its tendency to force a passage through bodies. They are ordinarily applied in chemistry for opposite purposes. Electricity is used to promote combination, galvanism to decompose bodies; but Becquerel, by employing simple voltaic circuits of weak action, has been able to form many crystalline substances, which cannot be effected by ordinary chemical action. Thus, from carbonate of lime, precipitated in the form of an amorphous powder, by ordinary chemical processes, he has, by the above means, obtained crystals of the carbonate, identical with those found in nature. Electricity may be considered as the manifestation of a small quantity of the electric fluid in a high state of tension; whilst galvanism appears to be a large quantity of the fluid in a low state of tension.

As in ordinary electricity, so in galvanic, there are two theories now in vogue, to explain the origin of this species of electric action, viz., that of contact proposed by Volta, and the chemical theory proposed by Fabroni, advocated by Wollaston, the most correct, and now perhaps the prevailing one.

Galvanism took its origin from the convulsion produced in the leg of a frog in the neighbourhood of an electrifying machine in action. From what has preceded, it is evident that this was a case of induced electricity. Galvani established upon it a theory relative to the vital principle; Volta, however, took up the investigation, and was led to the hypothesis that all bodies by their contact alone evolve electricity. Pursuing this idea, he took a plate of copper and of zinc, and putting them in contact, by delicate means, ascertained that they became oppositely electrified, the zinc positively, the copper negatively; he then (supposing the copper undermost) placed on the zinc a moistened piece of cloth, which, from the small electromotive action between liquids and solids, did not sensibly derange the former state. In virtue of conduction this moistened cloth becomes positively electrified with the zinc, and the zinc again takes from the copper the quantity of electric action necessary for the equilibrium; another couple of copper and zinc plates in the same order, *i. e.*, with the copper plates undermost, was placed on the cloth: then the upper zinc, in virtue of its contact with the copper, also possesses a certain quantity of positive electricity, and in virtue of its connexion with the under pieces takes an equal quantity; thus the electric action of the upper zinc is double that of the first. By thus continually alternating with the moistened cloth and double plates placed in the same order, he formed the celebrated Voltaic pile, in which theoretically the electric action of the uppermost zinc, in the comparison with the first, is proportionate to the number of couples of plates; the action of both the copper and zinc increasing from below to above. This supposes the lower copper in contact with the earth. If the pile be insulated, the electric actions decrease from the extreme plates to the middle. The extreme plates, or wires which are joined to them, are called the poles of the piles, or, as Mr. Faraday terms them, electrodes. At the zinc pole the positive electricity is manifested, at the copper the negative.

By connecting these poles, the ordinary electrical phenomena are observable, as attraction, evolution of light, and of heat. By connecting the poles through various substances the effects of the pile are manifested. With powerful instruments, the fusion of the most refractory substances is effected, volatilization of the metals, and all the phenomena of the electrical battery are produced. Interposing between the poles, water, chemical substances in solution, or more generally in a liquid state, their decomposition (if compound) is effected. Those substances which, in chemical combination, perform the function of an acid, appear at the positive pole; and those enjoying the properties of a base at the negative. So powerful is this effect, that ordinary chemical action appears suspended by voltaic influence. Thus, an acid in the above decompositions can pass through litmus without changing its colour. If, however, during its passage, an insoluble substance can be formed, precipitation will take place in spite of voltaic influence. Thus, if sulphuric acid, in its progress towards the positive pole, pass through nitrate of baryta, the insoluble sulphate will fall.

The galvanic trough or battery, so generally in use, acts on precisely the same principle: plates of zinc and copper are soldered together, or by conductors connected, and several of them in the same order are exposed together to the action of various fluids. Wires are attached to each end of the trough, the one touching the zinc, the other the copper plate. When these wires are brought into contact, light is produced, and a shock may be given to the moistened fingers, much resembling that producible by the Leyden jar.

The electric and galvanic fluids possess the property of giving magnetic action to substances, and within the last few years the intimate connexion between them has been established by very numerous experiments.

Water was the first substance decomposed by galvanism. This was accomplished by Sir Anthony Carlisle and Nicholson. Berzelius and Heisinger first observed the phenomena of transport, which Davy subsequently extended and generalized. On these facts, the modern electro-chemical theory greatly depends.

As all bodies have a certain chemical relation, it is customary to classify them under the heads of electro-positives and electro negatives. In the following table all known substances are placed in their electrical order, oxygen, the most electro-negative, being placed first; potassium, the most electro-positive, last. It was formerly the custom to consider the first twenty-one as negatives and the rest as positives, but this has been given up for some time, inasmuch as each substance is positive to all those preceding it, and negative to all that follow; thus, sulphur is negative to all other substances except oxygen, but in relation to that is positive,

In order to economise space, we have added to each substance its symbol, according to Berzelius, and its chemical equivalent as most commonly considered, omitting fractions.

Name.	Symbol.	Equiv. No.	Name.	Symbol.	Equiv. No.
Oxygen	O	8	Mercury	Hg.	100
Sulphur	S	16	Silver	Ag	108
Nitrogen	N	14	Copper	Cu	32
Chlorine	Cl	35	Uranium	U	60
Bromine	Br	80	Bismuth	Bi	71
Iodine	I	126	Tin	Sn	59
Fluorine	F	18	Lead	Pb	104
Phosphorus	P	31	Cerium	Ce	46
Selenium	Se	39	Cobalt	Co	30
Arsenic	As	75	Nickel	Ni	30
Chromium	Cr	28	Iron	Fe	28
Molybdenum	Mo	48	Cadmium	Cd	56
Tungsten	W	95	Zinc	Zn	33
Boron	B	11	Manganese	Mn	28
Carbon	C	6	Zirconium	Zr	34
Antimony	Sb	129	Aluminium	Al	14
Tellurium	Te	64	Yttrium	Y	32
Columbium	Cm	184	Thorium	Th	60
Titanium	Ti	24	Glucinium	G	26
Silicon	Si	22	Magnesium	Mg	13
Osmium	Os	100	Calcium	Ca	20
Hydrogen	H	1	Strontium	Sr	44
Gold	Au	99	Barium	Ba	69
Iridium	Ir	99	Lithium	L	6
Rhodium	R	52	Sodium	Na	23
Platinum	Pl	59	Potassium	K	39
Palladium	Pd	53			

It may be as well here to remark, that the equivalents of some of the preceding are differently given by other chemists. Thus, mercury is commonly considered as 202;

arsenic, antimony, phosphorus, and columbium, have had their equivalent number doubled in this table for motives of convenience. The equivalent of gold, too, is by some stated to be 198, just double the one here mentioned.

The exact situation of Vanadium (symbol V, eq. 69) is not as yet clearly defined. Nor are the newly discovered metals, Didymium (Dy, eq. 50 ?), Erbium (Er), Lantanum (Ln, eq. 47 ?), Niobium (Nb), Norium (No), Pelopium (Pe), Ruthenium (Ru, eq. 52), and Terbium (Tb), yet put into their proper place in the scale, nor are their chemical equivalents exactly known.

The symbols of the metals, &c., are in general derived from the first letter of the ordinary name, and when necessary for the sake of distinction, one or two more are added; but it must be borne in mind that all the more important substances have only the single letter, thus Oxygen is represented by O, whilst Osmium is given by Os.

The symbols of some of the metals are taken from the Latin names. Thus Tungsten is expressed by W, for its Latin name Wolframium; and Mercury by Hg, for Hydrargyrum. The other metals whose symbols are derived from their Latin terms, are Gold (Aurum), Copper (Cuprum), Iron (Ferrum), Lead (Plumbum), Antimony (Stibium), Sodium (Natrum), Potassium (Kalium), Silver (Argentum), and Tin (Stannum).

It will thus be seen that the whole of the substances composing this earth, as far as we know, are composed of 62 elements only; but it is extremely probable that many more exist, for no less than eight have been discovered within the last twelve years; and it is also extremely easy to imagine that many substances now considered as simple, may be eventually found to be composed of two or more elements.

ATOMIC THEORY.

In order to understand the atomic theory, the following axioms, or laws of chemical combination, should be recollected:

1. The composition of bodies is definite and invariable, both as regards the elements and their proportions. Thus, water is composed of 1 hydrogen and 8 oxygen by weight, and no other elements or proportions can form it.

2. Bodies combine in a few proportions only. Thus, zinc and oxygen combine in one proportion only; oxygen and hydrogen in two proportions; some bodies unite in three, four, or five proportions. We do not know the limit, but it seldom exceeds 5 proportions.

3. When one body, A, unites with another, B, in more than one proportion, the quantities of B are multiples by a simple whole number of the smallest quantity of B with which A can unite. Thus,

Nitrous oxide is composed of	nitrogen	14,	oxygen	8
Nitric oxide . . .	„	14,	„	16
Hypo-nitrous acid . .	„	14,	„	24
Nitrous acid . . .	„	14,	„	32
Nitric acid . . .	„	14,	„	40

From this table it will be easily seen that the quantities of oxygen contained in the four latter compounds are multiples of the quantity of oxygen contained in the first compound, viz. nitrous oxide. Thus, nitric oxide contains twice as much oxygen as nitrous oxide; hypo-nitrous acid thrice as much; and so on.

A knowledge of these three laws will assist most materially in understanding the atomic theory.

Two opinions have divided philosophers respecting the nature of the ultimate elements of bodies, ever since they began to speculate on the subject. According to one party, these ultimate elements are infinitely divisible, every particle of matter, however small, being capable of still further division, if our instruments and organs were adapted for the operation. According to the other party, these ultimate elements consist of certain small particles incapable of further division, and to which the term atom is applied.

In order to avoid discussion, the term atom is used in chemistry to signify the ultimate particles of which any body is composed, without considering whether the further division of these particles be possible or not. The shape of the particles, their size, and their weight, are of course perfectly unknown.

But, although the weight of the atoms be unknown, we know that the atoms of different bodies differ from each other in weight. Thus, although we cannot say what the actual weight of an atom of oxygen or of an atom of hydrogen is, yet we can tell what the relative weights of these atoms are. We can tell that an atom of oxygen is eight times heavier than an atom of hydrogen. So also we can determine the relative weights of the atoms of almost all other bodies.

Now, whenever combination between bodies takes place, it is between their ultimate particles or atoms. Thus, when oxygen and hydrogen combine to form water, the combination is between the particles or atoms of these elements, 1 atom of oxygen combining with 1 atom of hydrogen. An atom of one body may unite with 1, 2, 3, 4, or 5 (seldom more than this) atoms of another. Thus, in the foregoing table of the compounds of nitrogen and oxygen, it will be seen that nitrogen combines with 5 proportions of oxygen. In other words, 1 atom of nitrogen combines with 1, 2, 3, 4, 5 atoms of oxygen, forming five distinct compounds. It will be seen that 14 represents an atom of nitrogen and 8 an atom of oxygen.

The mode of ascertaining the proportional or atomic number is as follows: a definite compound of two simple substances which have an extensive range of affinity, is to be carefully analysed. Now, oxygen and hydrogen have an extensive range of affinity for other bodies; hence a compound of these two is selected. There are two compounds of oxygen and hydrogen, water and the peroxide of hydrogen: water is selected because it contains the smallest proportion of oxygen and hydrogen. Water is regarded as a compound of one proportion or atom of oxygen, and one proportion or atom of hydrogen. But analysis proves that water is composed of 8 parts by weight oxygen, and 1 part hydrogen. Hence, then, it follows that an atom of oxygen must weigh eight times as much as an atom of hydrogen.

Some compounds are next examined which contain either oxygen or hydrogen in combination with some other substance, the quantities of each being the smallest that can unite together. Carbonic oxide is composed of 8 proportions of oxygen and 6 carbon; sulphuretted hydrogen of 1 hydrogen and 16 sulphur. Hence the atomic or proportional number for carbon is 6, and for sulphur 16. The numbers of all other bodies may be determined in the same manner. From these observations then we come to the understanding, that atomic numbers represent the proportions in which bodies combine by weight.

This may be illustrated in the following manner. If we take 50 grains of chalk, and expose it to such a temperature that the carbonic acid is expelled, the 50 grains will lose 22 of their weight, which corresponds with the atomic number of carbonic acid.

A knowledge of these facts may become highly useful to the manufacturer, as he is thus enabled to mix, in exact proportions, the various substances intended to form certain compounds.

SIMPLE PONDERABLE SUBSTANCES.

The simple or elementary ponderable bodies are those which we are unable to reduce to other constituent parts. They are sixty-two in number, and may be classified in various ways. Some may be called combustible, others supporters of combustion; some are electro-negative, others electro-positive. But the most simple division is that into metallic and non-metallic bodies.

The non-metallic bodies are,

Oxygen
Chlorine
Iodine
Bromine
Fluorine
Nitrogen
Silicon
Boron
Carbon
Hydrogen
Sulphur
Selenium
Phosphorus.

The metallic bodies are the following, and are thus classified by Dr. Fownes—

1.

Metals of the Alkalies.

- **Potassium**
- **Sodium**
- **Lithium**
- **Ammonium (hypothetical).**

2.

Metals of the Alkaline Earths.

- **Barium**
- **Strontium**
- **Calcium**
- **Magnesium.**

3.

Metals of the Earths.

- **Aluminium**
- **Glucinium**
- **Yttrium**
- **Erbium**
- **Terbium**
- **Zirconium**
- **Norium**
- **Thorium**
- **Cerium**
- **Lantanium**
- **Didymium.**

4.

Metals whose Oxides form Powerful Bases.

- **Manganese**
- **Iron**
- **Chromium**
- **Nickel**
- **Cobalt**
- **Copper**
- **Zinc**
- **Cadmium**
- **Bismuth**
- **Lead**
- **Uranium.**

5.

Metals whose Oxides form Weak Bases or Acids.

- **Vanadium**
- **Tungsten**
- **Columbium**
- **Molybdenum**
- **Niobium**
- **Pelopium**
- **Titanium**
- **Tin**
- **Antimony**
- **Arsenic**
- **Tellurium**
- **Osmium**

6.

Metals whose Oxides are reduced *by Heat.*

- **Gold**
- **Mercury**
- **Silver**
- **Platinum**
- **Palladium**
- **Iridium**
- **Ruthenium**
- **Rhodium**

The simple elementary gases are four, namely, oxygen, hydrogen, nitrogen, and chlorine.

In speaking of the properties of gases, fluids, and solids, we generally mention that they have a certain specific gravity. By specific gravity is meant the relative weight of equal bulks of bodies. Atmospheric air is taken as the standard for gases, and water for liquids and solids. They are both taken as unity, or one thousand, although water is 815 times heavier than atmospheric air.

Gases are estimated by a specific-gravity bottle, which will contain a definite number of grains of atmospheric air; if this air be expelled, and another gas be introduced, and the bottle be then weighed, the difference will be perceptible, supposing a vessel to contain 1000 grains of atmospheric air, the same bulk of chlorine will weigh 2470 grains, of oxygen 1105, of hydrogen only 68 grains and a fraction.

The specific gravity of liquids is also ascertained by a proper bottle. Thus, suppose one to contain 1000 grains of water, and this water to be poured out and replaced by mercury, an equal bulk of the latter will weigh 13,545 grains. Thus we know that mercury is 13½ times heavier than water.

There is more difficulty with solids, especially when lighter than water, for in that case it becomes necessary to attach to them a sufficient quantity of any substance of known specific gravity, so as to make it sink in water, and this has to be allowed for in the final result.

If we take a piece of metal and weigh it in a pair of scales, and ascertain its weight, we call this its absolute weight; it is then necessary to ascertain what an equal bulk of water would weigh. This is done by putting the metal into a vessel filled with water, in which case water will be displaced equal to the bulk of the metal. This water must be weighed, and its weight be compared with that of the solid. If the metal weighed 100 grains, and the water 20, we understand that the metal is 5 times heavier than water; and as we agree upon calling water 1000, the specific gravity of the metal will be 5000.

There is another modification of this principle employed. If, after obtaining the absolute weight of the metal, it be suspended from the end of the beam of the scales by a fine thread, and be received in water and again weighed, it will be found to have lost weight, which loss is exactly equal to the weight of the water displaced by the former proceeding. Thus, instead of 100 grains, it will now only weigh 80 grains. The loss is to be taken as the divisor of the absolute weight, and the quotient will give the number of the times which the metal exceeds the water in weight.

If the substance of which the specific gravity is desired to be known be soluble in water, it must be weighed in alcohol or oil of turpentine, and a correction made for the different specific gravities of these substances as compared with that of water.

In all cases of obtaining the specific gravity it is necessary to note the temperature of the atmosphere. This is generally taken at 62°.

OXYGEN.

Oxygen gas. *Properties.*—Devoid of colour, taste, and smell. Sp. gr. 1·1057; 100 cubic inches weigh 34·193 grains. It is a negative electric appearing at the positive pole; a non-conductor of electricity, the chief supporter of combustion; necessary for animal life. A lighted paper introduced into it burns with great brilliancy. The word oxygen is derived from οξυς, acid, and γενναω, I generate; having been supposed to be the sole acidifying principle. 100 cubic inches of water absorb about 3·5 grains. Equiv. 8. Symbol O.

It is procured from peroxides of metals, chlorate of potash, &c. It is most cheaply obtained by heating the peroxide of manganese in an iron vessel; in which case oxygen is evolved, and a deutoxide of manganese is left. This gas may be collected over water.

Peroxide of manganese with sulphuric acid produces a sulphate of the protoxide of manganese, and one atom of oxygen is evolved, being twice the quantity that we obtain by heat alone.

Chlorate of potash, heated in a glass vessel, is decomposed and affords six atoms of oxygen, with chloride of potassium remaining in the retort; but it will not give up all its oxygen unless a little binoxide of manganese be mixed with it.

Peroxide of mercury by heat will resolve itself into two equivalents of oxygen and metallic mercury. This process is too expensive. Nitrate of potash, heated carefully in a glass retort, will part with one equivalent of oxygen gas. Oxygen may also be obtained in small quantity from water by means of the galvanic battery.

Oxygen, by combining with metals, forms numerous compounds, such as oxides, acids, alkalies, alkaline earths, and earths.

The union with bodies, assisted by heat, is often attended with the phenomenon called combustion.

Ordinary combustion may be defined, a rapid union of oxygen with a combustible body, attended with an evolution of light and heat.

HYDROGEN.

Hydrogen gas, known also as inflammable air, is the lightest ponderable body, and exists in most animal and vegetable substances. Its name is derived from ὕδωρ, water, and γεννάω, I generate. It is readily procured by decomposing water; either by passing its vapour into a tube over red-hot iron filings, or from a mixture of sulphuric acid, water, and zinc, or iron filings. In these cases water is decomposed, the oxygen combining with the metal, and the hydrogen is evolved. In the latter process it is often contaminated with some offensive oily matter, hydrosulphuric acid, or carburetted hydrogen, from which, excepting the latter, it may be separated by passing it through a solution of potash. Hydrogen is suspected to be a metal; if so, water would be the oxide of a metal.

Properties.—Devoid of colour, taste, and smell; sp. gr. ·0691; a powerful refractor of light. 100 cubic inches weigh 2·14 grains; it does not support respiration, though not positively injurious to animal life; is a non-supporter of combustion, but combustible; when a mixture of two volumes of hydrogen and one of oxygen is ignited by a flame or electricity, violent explosion takes place, and water is formed. If either gas be in excess, water is still formed and the superfluous gas remains. It is at the present time considered by some chemists to be the cause of acidity instead of oxygen, as formerly supposed; but the arguments are not strong enough to induce us to change all our preconceived notions on that subject. According to the hydrogen-acid theory, sulphuric acid should be written SO_4H. The equivalent of hydrogen is 1. Symbol H.

The compounds of hydrogen with oxygen are two, viz., water and the peroxide of hydrogen.

WATER.

Composition :

	By weight.	*Volume.*
Oxygen	8	1
Hydrogen . . .	1	2

Equiv. 9. Symb. HO.

Properties.—A colourless transparent liquid possessing neither taste nor smell; refractor of light: sp. gr. unity or 1000, taken as the standard of comparison for liquids and solids. 1 cubic inch weighs 252 grains; it is 815 times heavier than atmospheric air. The sp. gr. of watery vapour is ·6202, that of ice ·920. The purest water existing naturally is that from rain or melting snow; it is found, however, to have absorbed oxygen. The water formed by the melted Wenham Lake ice is said to be exceedingly free from impurity. The sparkling of water, ordinarily, is owing to the carbonic acid absorbed by it, which may be equal to its own volume under the ordinary pressure and temperature of the atmosphere. Bodies chemically combined with water are called hydrates, and some chemists look upon this as a base; thus medicinal sulphuric acid they call a sulphate of water.

Spring water frequently contains either the sulphate of lime, or carbonate of lime with excess of carbonic acid. It sometimes holds in solution chloride of calcium or sodium. Spring water, commonly called *hard water*, is usually rendered turbid by soap, from the margaric and oleic acids, forming insoluble compounds with the lime.

Sea water contains a considerable quantity of saline matter, amounting on an average to 3 per cent. Sp. gr. from 1·026 to 1·028. Freezes at 28·5. The chief ingredients are *chloride of sodium*, *chloride of magnesium*, *sulphate of magnesia*, and *sulphate of lime*, with a trace of potash, iodine, and bromine.

The *peroxide of hydrogen*, or oxygenated water, is procured by adding to water peroxide of barium and hydrochloric acid, in successive quantities; subsequently, sulphuric acid and sulphate of silver; and lastly solid baryta, to remove all the sulphuric acid.

Properties.—A colourless liquid; whitens and softens the skin; bleaches powerfully; is easily decomposed by heat, oxygen flying off with effervescence; should be kept surrounded by ice. Sp. gr. 1·452.

A *teroxide of hydrogen* is also spoken of by some authors, but is not yet agreed upon.

NITROGEN.

Nitrogen is one of the simple or elementary gases, existing in greatest abundance in the atmosphere. It is also named azote, from α, privative, and ζωη, life, because it is not a supporter of respiration.

It may be most readily procured by burning phosphorus in a jar containing atmospheric air, or by the action of nitric acid on fresh muscle.

In the first process the phosphorus combines with the oxygen, and forms pyrophosphoric acid, which is soon dissolved by the water, leaving in the jar nitrogen, with a little carbonic acid and vapour of the phosphorus. The gas is then to be passed through a solution of potash or lime, and the nitrogen emerges pure.

In the second process, by the action of the nitric acid on the muscle, nitrogen in considerable quantity, with a little carbonic acid, is evolved. The gas should be passed through lime water. The nitrogen is derived principally from the fibrine of the muscle.

Properties.—Devoid of colour, taste, and smell; neither a supporter of combustion, nor combustible; does not support respiration, but is only negatively injurious to animal life, killing animals by the exclusion of oxygen. Sp. gr. ·972; 100 cubic inches weigh 30·166 grains. Equiv. 14·06. Symbol N.

The compounds of nitrogen with oxygen are five, and in the following proportions:

	Oxygen.	*Nitrogen.*
Nitrous oxide	1	1
Nitric oxide	2	1
Hyponitrous acid	3	1
Nitrous acid	4	1
Nitric acid	5	1

In addition to these, the atmosphere is composed of oxygen and nitrogen; but they appear to exist in it only in a state of admixture.

ATMOSPHERE.

Composition by volume: 79 or 80 of nitrogen, and 20 or 21 of oxygen; that is, in the ratio of about 4 to 1, with a very small proportion of carbonic acid, never exceeding 1000th part. It is colourless, devoid of smell and taste; sp. gr. (taken as the standard of comparison for other gases) is unity; it is 815 times lighter than water; 100 cubic inches weigh 31·0117 grains. Its pressure on a square inch is equal to about 15lbs.; it can support a column of mercury of 30 inches, and one of water of 34 feet at the level of the sea. On the knowlege of this principle, barometers are constructed, and water is raised in pumps.

It is calculated to extend to about 45 miles above the level of the sea, at which point its diffusive power is terminated by the attraction of the earth.

NITROUS OXIDE. PROTOXIDE OF NITROGEN, OR LAUGHING GAS.

This gas is readily procured by decomposing nitrate of ammonia in a glass retort by heat. The hydrogen of the ammonia, uniting with 3 atoms of oxygen of the acid, forms 3 atoms of water; the remaining oxygen and nitrogen of the acid, with the nitrogen of the ammonia, form 2 atoms of the protoxide of nitrogen.

Properties.—A colourless gas, with slight taste and odour; a powerful supporter of combustion; respirable for a few minutes, producing great excitement of the system, with a tendency to laughter. Water absorbs its own volume, and gives it out again when heated. It is best collected over warm water or mercury. Sp. gr. 1·525. Equiv. 22·06. Symbol NO.

BINOXIDE OF NITROGEN, NITRIC OXIDE, OR NITROUS GAS.

This gas is procured by the action of nitric acid on copper. Three equivalents of copper decompose 1 equiv. of nitric acid; 3 equiv. of oxide of copper are formed, and 1 equiv. of binoxide of nitrogen is set free. It may be collected over water or mercury.

Properties.—Colourless, tasteless, and inodorous; brought in contact with atmospheric air or free oxygen, it forms the red nitrous-acid fumes. It is irrespirable, producing spasm of the glottis; a very feeble supporter of combustion. Charcoal and phosphorus immersed in it in a state of vivid combustion burn for a moment with increased brilliancy; it is sparingly absorbed by water. Sp. gr. 1·039. Equiv. 30·06. Symbol NO_2.

HYPONITROUS ACID. (Nitrous Acid, Fownes.)

Much doubt and confusion exist in the minds of chemists respecting hyponitrous and nitrous acids, and I shall repeat in the present what I stated in the former edition.

This acid has only of late been admitted as procurable in a free state. It is formed by keeping binoxide of nitrogen in a tube with a solution of potash over mercury for the space of two or three months. The binoxide of nitrogen is decomposed, and resolved into hyponitrous acid and protoxide of nitrogen, the former of which combines with the potash. It is also formed by mixing an excess of binoxide of nitrogen with oxogen gas, kept over a strong solution of potash, and this over mercury. The acid produced combines with the potash. Dulong procured it by mixing the gases, and exposing them to intense cold. Its existence was presumed from the fact that when an acid is added to the hyponitrite of potash, nitrous acid and nitric oxide are evolved.

Properties.—At zero it is a colourless liquid, but becomes green at ordinary temperatures; it is very volatile; by water it is decomposed and resolved into nitric acid and binoxide of nitrogen, which flies off with effervescence. It is of no particular use in chemistry or medicine.

Equiv. 38·06. Symbol NO_3.

NITROUS ACID. (Hyponitric Acid, Fownes.)

Peroxide of nitrogen (Graham).

This acid may be procured by mixing binoxide of nitrogen with oxygen gas, or by heating the nitrate of lead, which has been carefully dried. The nitric acid is driven off in the form of nitrous acid and oxygen. Nitrous acid can exist either in a gaseous or liquid state, but for the latter a low temperature is required.

Properties of nitrous-acid gas.—Orange-red colour, pungent suffocating odour; irrespirable; readily absorbed by water, and, resolved into nitric acid and binoxide of nitrogen, supports the combustion of ignited phosphorus, or even of a taper.

Properties of the liquid acid.—Yellowish orange colour at 60; yellow at 32; colourless at zero. Pungent odour; highly corrosive; strong acid taste; stains the skin yellow; is very volatile. Exposed to the air it passes rapidly into vapour. It parts with its oxygen readily to some metals.

During the admixture of small portions of water to this acid, remarkable changes of colour ensue, passing from colourless to blue, green, yellow, and orange. Equiv. 46·06, Symbol NO_4.

NITRIC ACID.

This acid may be obtained by passing electric sparks through a mixture of oxygen and nitrogen, with a little water over mercury, or by keeping the binoxide of nitrogen with oxygen over water. Water is necessary for the existence of liquid nitric acid. Absolute nitric acid was procured first by Mr. Deville in 1849, by exposing nitrate of silver to the action of chlorine; in which case chloride of silver is formed, and nitric acid with free oxygen are liberated. It is a colourless solid, crystallizing in six-sided prisms; it fuses at 86° F., and boils between 113° and 122°; and has been known sometimes to explode spontaneously. The ordinary nitric acid of commerce is obtained by pouring strong sulphuric acid upon the nitrate of potash; a bisulphate of potash is formed, and the nitric acid, with the water of the sulphuric acid, passes over, and is condensed in a receiver. This acid, when pure, is colourless; but is commonly found combined with a small portion of nitrous acid, which gives it a yellowish-red colour. If heat be applied, the nitrous acid flies off, and nitric acid is left in a colourless state. The sp. gr. is 1·500; its equiv. is

54·06. Extensive use is made of it in chemistry to impart to metals their maximum of oxidation. Mixed with water heat is evolved. It may be decomposed by passing nitric oxide through it, which will form nitrous acid. It is also decomposed by the solar rays being resolved into nitrous acid and oxygen. Nitric acid in its strongest state has always 1 equivalent of water in combination, so that its equivalent must be 63·06. Symbol, NO_5 HO.

CARBON.

Carbon is a simple elementary non-metallic body, existing in its purest state in the form of the diamond; and in the next degree in plumbago, which contains on an average 97 per cent. of carbon. A less pure form of it is the black opaque substance called charcoal. Charcoal may be procured from wood, coal, animal matter, oil of turpentine, and alcohol; the latter of which affords it in its purest artificial state. It is obtained by heating to redness these several substances in closed vessels, so as to prevent the oxygen of the air combining with the carbon, which would escape in the form of carbonic acid gas.

The charcoal from bones is called *ivory-black*, or *animal charcoal;* that from coal, *coke;* and that from resin, tar, and oils, *lamp-black.*

Properties of charcoal.—Bad conductor of heat; good conductor of electricity; absorbs gases, which it yields again when heated, and possesses this property most powerfully in the compact state. It also absorbs water, deprives bodies of their colour, taste, and smell; hence employed as a decolorising agent, and to purify tainted flesh and water; combustible, affording by the combustion carbonic acid; unites with oxygen in three proportions, forming carbonic oxide, oxalic acid, and carbonic acid.

The *diamond* is the hardest body in nature, sp. gr. 3·520; it is a powerful refractor of light, and combustible. For its combustion it requires a very high temperature. Lavoisier effected the combustion of the diamond by concentrating upon it the sun's rays with a powerful lens, in a jar of oxygen gas. The diamond disappeared, and carbonic acid was found to be produced equal in weight to the diamond and oxygen engaged.

Equiv. of carbon 6. Symbol C.

CARBONIC ACID.

Composition :

1 carbon 6
2 oxygen $2 + 8 = 16$
Equiv. 22. Symb. CO_2.

This gas may be readily procured from white marble, by pouring upon it dilute hydrochloric or sulphuric acid. The acid combines with the lime, and sets carbonic acid free.

Properties.—Colourless, insipid, and inodorous: sp. gr. 1·524 ; extinguishes flame, very destructive to animal life; when pure, it kills by occasioning spasm of the glottis ; diluted, it acts as a narcotic poison ; makes lime water turbid by uniting with the lime ; is absorbed by water in the proportion of equal volumes at the ordinary pressure of the atmosphere ; if the pressure be increased, water can absorb several times its volume.

Carbonic acid is found in pits, and is then known as *choke-damp ;* it is always evolved in lime-kilns ; is found in malt-houses, brewers' vats, cellars, &c. Its presence in champagne, ale, porter, and even water, gives them most of their agreeable sharpness. The rapid escape of carbonic acid from fluids is the general cause of effervescence. It is given out from the lungs and skin by animals, as well as the other sources mentioned, and is, consequently, always found in the atmosphere. It combines with alkalies, forming carbonates ; but has so weak an affinity, that it is displaced by nearly every other acid.

The escape of carbonic acid from the body may be shown by immersing any part of it in lime-water, when carbonate of lime will be deposited on the skin, and the water will be made turbid.

CARBONIC OXIDE GAS.

This gas may be produced by heating to redness in a gunbarrel, iron filings with twice the quantity of dried chalk ; the carbonic acid, set free, is almost entirely decomposed by the iron, and carbonic oxide passes over. Any undecomposed carbonic acid may be separated by passing the gas through lime-water. It may also be obtained by passing a stream of carbonic acid over red-hot charcoal, or by decomposing the binoxalate of potash with sulphuric acid in a retort. By the application of heat carbonic acid and oxide are evolved, the former of which is absorbed by a solution of caustic potash, the latter is passed through water for use.

Properties.—It is devoid of colour, taste, and smell; combustible; extinguishes flame; a taper immersed in it is extinguished, but the gas burns on the surface with a bluish flame, and carbonic acid is the product. It is irrespirable, and if introduced into the lungs produces profound coma. It does not unite with lime or the pure alkalies, but passes through their solutions unchanged.

Composition.—1 carbon, 1 oxygen; equiv. 14; sp. gr. ·972. It is almost always generated when vegetable substances are decomposed by heat in closed vessels. Symbol CO.

SULPHUR.

Sulphur is a simple elementary body, existing in a solid state, chiefly procured in the neighbourhood of volcanoes, and found copiously combined with many of the metals, especially iron, copper, lead, and antimony.

Properties.—A brittle solid of a yellow colour, and disagreeable odour when rubbed; a non-conductor of electricity. Sp. gr. 1·990; it fuses at 232°, passes rapidly into vapour between 572° and 600°; heated in the air to a temperature of about 300° it takes fire, and forms with the oxygen, sulphurous acid gas. Equiv. 16. Symbol S.

Compounds of sulphur with oxygen—

	Sulphur.	*Oxygen.*	*Equiv.*
Hyposulphurous acid	2	2	48
Sulphurous acid	1	2	32
Hyposulphuric acid	2	5	72
Sulphuric acid	1	3	40
Sulphuretted hyposulphuric acid	3	5	88
Bisulphuretted hyposulphuric acid	4	5	104
Trisulphuretted hyposulphuric acid	5	5	120

SULPHUROUS ACID GAS.

Sulphurous acid in its pure state is a colourless gas, possessing a most suffocating odour. It may be obtained by burning sulphur in dry atmospheric air or oxygen gas, or, more conveniently, by heating copper or mercury and strong sulphuric acid together in a glass retort, and collecting the gas over mercury.

Rationale: a portion of the sulphuric acid is resolved into sulphurous acid and oxygen; the latter combines with the mercury, and, with undecomposed sulphuric acid, forms a biper-sulphate of mercury, while the former passes over.

Properties.—Irrespirable, causing death by producing spasm of the glottis; extinguishes flame; water absorbs about 33 times its volume; it has very powerful bleaching properties; is easily liquefied by compression; sp. gr. 2 2105. In combination with metallic oxides it forms the salts called sulphites. It has a great tendency to combine with more oxygen, so as to form sulphuric acid, but only when water is present, and it will take oxygen from substances which have not much affinity for it.

Equivalent of sulphurous acid, 32. Symbol SO_2.

SULPHURIC ACID.

This acid may be procured from the sulphate of iron by the application of heat, in which case sulphurous acid, sulphuric acid, and oxygen are disengaged, and peroxide of iron is left in the retort. It is usually obtained in this country by the process described in the decompositions of the Pharmacopœia.

This acid obtained from sulphate of iron is called Nordhausen, from the place where it has been largely obtained. It is a dense liquid with a brownish colour; emits vapours when exposed to the air; sp. gr. 1·90. Is composed of two equivalents of sulphuric acid and one of water. From this liquid, by careful distillation into a very cool receiver, crystallized anhydrous sulphuric acid may be obtained. This solid acid becomes liquid at about 66°, and by exposure to the air passes into vapour.

Properties of the common acid.—A dense colourless liquid, of an oily consistence and appearance; boils at 620 degrees. Sp. gr., when most concentrated, not exceeding 1·845; highly corrosive, destroying most animal and vegetable substances, occasioning a deposit of charcoal; has a very strong affinity for alkalies, and also for water, with which it unites in every proportion. If four parts by weight of this acid and one of water be suddenly mixed together, the temperature is raised to 300 degrees, arising from the condensation of the liquids. It absorbs watery vapour from the atmosphere, and is used, therefore, for hygrometrical purposes, and it may also be used for drying gases.

Equivalent of anhydrous sulphuric acid, 40. Symbol SO_3.

HYPOSULPHUROUS ACID.

This acid cannot exist for many minutes in an isolated state, speedily resolving itself into sulphurous acid and sulphur. It is formed by the action of sulphur upon a solution of a sulphite. The sulphur attracting an atom of oxygen from the sulphurous acid, forms hyposulphurous acid, which combines with the base. It is obtained also by introducing sulphurous acid into a solution of the sulphuret of strontium or calcium.

Hyposulphites are mostly soluble in water, and possess a bitter taste. Their only property of importance is their power of dissolving the chloride and iodide of silver. Symbol, $S_2\ O_2$.

HYPOSULPHURIC ACID. (*Dithionic Acid.*)

This acid is formed by transmitting sulphurous acid gas through water containing binoxide of manganese; sulphuric and hyposulphuric acids are formed, both of which combine with the protoxide of manganese. Solution of pure baryta is then added, the protoxide of manganese is precipitated with sulphate of baryta, leaving the hyposulphate of baryta in solution; when to this sulphuric acid is added, an insoluble sulphate of baryta is precipitated, and the hyposulphuric acid is set free.

Properties.—Colourless; devoid of smell; combines with the alkalies, forming neutral salts; unlike sulphuric acid, it forms soluble compounds with baryta, strontia, lime, and oxide of lead. By heat applied either to the acid or its salts, it is resolved into sulphurous and sulphuric acids. Symbol, $S\ O_5$.

PHOSPHORUS.

This substance may be procured from urine or from bones: when the former is employed, phosphoric acid is separated by acetate of lead; the phosphate of lead may then be decomposed by heating it with charcoal. It is generally procured at present from bones. The bones are first to be calcined, then heated with sulphuric acid, by which a comparatively insoluble sulphate of lime, and a very soluble superphosphate of lime are formed. The superphosphate is taken up by warm water, which is then to be evaporated to the consistence of syrup. A third of its weight of charcoal is added to this, and heat is applied, when the charcoal, with the oxygen of the phosphoric acid, forms carbonic acid, while phosphorus passes over, and is collected in water in a receiver.

Properties.—A transparent solid; sp. gr. 1·77; soft; of a waxy consistence and appearance when cut; generally of a light yellow or red colour; exposed to the air it burns slowly, with emission of light, which is visible in a dark place, and giving out at the same time a disagreeable alliaceous odour. It is very inflammable, burning rapidly when even gently rubbed, or by raising its temperature a little above its point of fusion, which is 108 degrees Fahr. It passes rapidly into vapour at 550°. It burns most vividly in oxygen gas, with production of intense heat; is soluble in naphtha, fixed and volatile oils, and ether. It should be kept in water; placed in a jar of atmospheric air, it absorbs or unites with the oxygen, leaving the nitrogen free.

There is a peculiar modification of this substance known by the name of *amorphous* phosphorus. It is procured by heating ordinary phosphorus to a temperature of 550° for about three days, in a place where the phosphorus cannot be acted upon by oxygen. It becomes a dark reddish-brown, cohesive, infusible substance; sp. gr. about 2·100, is not luminous in the dark unless heated up to about 400 degrees, and is not disposed to unite with oxygen of the air.

The compounds of phosphorus with oxygen are three, and, according to some chemists, four. They are oxide of phosphorus, hypophosphorous, phosphorous, and phosphoric acids. Equiv. 31. Symbol P.

OXIDE OF PHOSPHORUS.

The oxide of phosphorus is obtained by bringing oxygen gas in contact with phosphorus while fused under water. Combustion takes place, and phosphoric acid and oxide of phosphorus are produced ; the latter is in the form of little red globules, but is considered by Schrotter to be amorphous phosphorus.

It is without odour or taste and is insoluble in water, alcohol, or oils. Permanent in the air. It is not applied to any chemical uses.

Composition :

2 phosphorus	1 oxygen.

HYPOPHOSPHOROUS ACID.

This acid is obtained by acting on the phosphuret of barium with water The water is decomposed, giving rise to the production of phosphuretted hydrogen, phosphoric, and hypophosphorous acid. The latter forms a soluble compound with baryta, which is then to be decomposed by sulphuric acid, so as to set free the hypophosphorous acid. This acid is particularly characterised by forming very soluble compounds with alkalies. It has a strong tendency to combine with more oxygen, and may consequently be used as a deoxidizing agent. Its most soluble and deliquescent salt is the hypophosphite of potash, which is even more deliquescent than chloride of calcium. Symbol, PO.

Composition:

1 phosphorus	1 oxygen.

Equiv. 39.

PHOSPHOROUS ACID.

This acid is obtained by burning phosphorus in highly rarefied air, or by decomposing the chloride of phosphorus in water. Hydrochloric and phosphorous acids are formed ; the former is expelled by heat.

Properties.—A white solid, soluble in water: disposed to attract oxygen and form phosphoric acid; it has an alliaceous odour; by combining with alkalies it forms salts, named phosphites.

Composition :

1 phosphorus 3 oxygen.
Equiv. 55. Symbol, PO_3.

PHOSPHORIC ACID.

Phosphoric acid is obtained from bones acted upon by sulphuric acid, or by burning phosphorus in a jar containing dry atmospheric air or oxygen gas. The white flakes which fall are pyrophosphoric acid. This acid, by exposure to moisture, becomes phosphoric acid. It may also be obtained by the action of nitric acid on phosphorus, but most cheaply from bones. The bones are first to be calcined, then treated with sulphuric acid: the superphosphate is boiled with carbonate of ammonia. The soluble phosphate of ammenia is then heated, and the ammonia flies off. This leaves metaphosphoric acid, which, by the addition of water, is converted into phosphoric acid.

Properties.—Colourless, with a strong acid taste, combines readily with alkalies, forming sub-salts in the proportion of one of the acid to three of the base. When in an anhydrous state its symbol is PO_5, it being composed of—

Phosphorus . . .	1 =	31
Oxygen	5 =	40
		71

Phosphoric acid has attracted a great deal of attention latterly from its three peculiar modifications, all of which form distinct salts.

When phosphoric acid exists combined with alkalies in general, it is as a tribasic acid; thus, phosphate of soda is formed by one equivalent of phosphoric acid being united with three of base, of which two are soda and one water. This tribasic or common phosphoric acid gives a yellow precipitate with the ammoniacal nitrate of silver.

On heating the phosphate of soda so as to drive off the whole of the water of crystallization as well as the basic water already mentioned, we have left the phosphoric acid united with two of soda only. The acid in this state is called pyrophosphoric or bibasic phosphoric acid, and gives a white precipitate with the solution of silver.

The monobasic or metaphosphoric acid is obtained by adding phosphoric acid to the tribasic phosphate of soda, and heating so as to drive off the whole of the water of crystallization as well as the whole of the basic water. We have left the metaphosphate of soda, from which the metaphosphoric acid is got by acetate of lead and sulphuretted hydrogen. Metaphosphoric acid gives a white precipitate with the salts of silver, and is distinguished from pyrophosphoric acid by its power of coagulating albumen.

Anhydrous phosphoric acid may be prepared by burning phosphorus in dry air or oxygen gas. It does not exhibit its peculiar properties till dissolved in water, when it becomes tribasic phosphoric acid.

Composition :

Anhydrous phosphoric acid . . .	PO_5
Metaphosphoric acid	$PO_5 + HO$
Pyrophosphoric acid	$PO_5 + 2\ HO$
Common phosphoric acid . . .	$PO_5 + 3\ HO$

BORON.

This is a simple elementary body, forming, with oxygen, boracic acid. It was discovered by Sir Humphry Davy, and was separated from oxygen by the galvanic battery. It is procured more readily by heating potassium with boracic acid, or by decomposing the borofluoride of potassium or sodium, by means of potassium.

Properties.—A dark olive coloured solid, without taste or smell; not affected by water; heated to 600° in the air it inflames, and with the oxygen of the air forms boracic acid: it abstracts oxygen readily from all substances which contain a large quantity of it. Equiv. 10·9. Symbol, B.

Boracic acid.—The only compound of boron and oxygen may be obtained from borax by the action of sulphuric acid, which combines with the soda, setting free the boracic acid. This acid is obtained in a solid state; when dissolved in alcohol and ignited it gives a green colour to the flame. It has feeble acid properties, being displaced from bases by most other acids, and produces a reddish-brown colour with turmeric like alkalies. Its most remarkable property is that of giving fusibility to the bodies with which it unites.

Composition of boracic acid :

1 boron 3 oxygen.
Equiv. 34·9. Symb. BO_3.

The crystallized acid contains 3 equivalents of water.

SELENIUM.

Selenium is a simple elementary body, found in combination with sulphur and several metals, particularly iron and lead. It has a leaden hue, but is red when powdered; is solid at ordinary temperatures; heated to 212° it softens, and boils at 630°. Sp. gr. 4·303; insoluble in water: heated in the air it unites with oxygen, forming oxide of selenium and selenious acid, and gives out a very powerful odour, resembling horseradish. Equiv. 39·5.

The compounds of selenium with oxygen are three:

	Selenium.	*Oxygen.*
Oxide of selenium . . .	1	1
Selenious acid . . .	1	2
Selenic acid . . .	1	3

The oxide of selenium, procured as above, is a colourless gas, and produces the horseradish odour when selenium is heated in the air.

Selenious acid is obtained by the action of nitric acid on selenium. It is a white solid; absorbs moisture from the air, and easily parts with its oxygen to substances which have a strong affinity for it, being precipitated pure, in the form of a red powder.

Selenic acid is obtained from seleniate of soda and nitrate of lead. The seleniate of lead which is thus formed is decomposed by sulphuretted hydrogen, and selenic acid is liberated, and remains in solution in water.

Properties.—A heavy, transparent, colourless liquid, possessing a strong affinity for water, by combining with which great heat is evolved, as by mixing water and sulphuric acid together. With hydrochloric acid it behaves like nitric, by setting chlorine free, and forming a solvent for gold and platinum. In most of its combinations it very much resembles sulphuric acid, having a very strong affinity for earths and alkalies. Sp. gr. 2·60.

SILICON, *alias* SILICIUM.

Silicon, the base of silica, is now classed amongst non-metallic bodies, as it wants some of the properties of metals. It was first obtained pure by Berzelius, in 1824. It is most conveniently prepared by acting upon the double fluoride of silicon and potassium, or sodium, by potassium in a tube, with the assistance of heat; silicon is set free, and fluorine unites with the potassium.

Properties.—A solid, of a nut-brown colour, without metallic lustre; a non-conductor of electricity; not acted upon by the blow-pipe; is not combustible either in oxygen or atmospheric air; not dissolved by the strong acids separately, but by a mixture of hydrofluoric and nitric acids; mixed with carbonate of soda or potash, and heated, it burns actively; with oxygen it forms silicic acid or silica. Equiv. 21·3.

Silicic acid, silica, or siliceous earth, composed of one silicon and three oxygen, is very abundant in nature. It forms flint, sand, quartz, chalcedony, onyx, agate, &c., and may be obtained from quartz sufficiently pure, by making it red-hot, throwing it into water, and subsequently pulverizing it.

Properties.—A white solid, without taste or smell: fuses before the oxy-hydrogen blowpipe; soluble in water only in its nascent state, when it forms a gelatinous, bulky hydrate. Sp. gr. 2·69.

Silicic acid, although it has no acid reaction on test papers, behaves like an acid in combining with bases; with carbonate of soda or potash it displaces carbonic acid, and forms a silicate, which will be more or less soluble, according to the proportions; with soda and potash it forms glass, which differs with the nature of the alkali and foreign substances contained in it. Green glass contains some iron. Plate glass is free from impurities. In flint glass oxide of lead is introduced. The composition of common flint glass is said by Mr. Faraday to be in the proportion of about—

4 silicic acid,
1 potash,
1 oxide of lead.

Equiv. of silicic acid, 45·3. Symb. $Si\,O_3$.

CHLORINE.

Chlorine is one of the four simple elementary gases, but was for some time supposed to be a compound body.

It may be procured from hydrochloric acid, by adding to it binoxide of manganese, and applying a moderate heat. The gas passes over, and should be collected in glass vessels over warm water.

It may be obtained for ordinary purposes by a cheaper process, that is, by mixing three parts of sea-salt with one of binoxide of manganese, two of sulphuric acid, and the same weight of water.

In the first process the hydrochloric acid is decomposed; two equiv. of oxygen of the binoxide combine with the hydrogen of the two atoms of hydrochloric acid, forming two equiv. of water, chlorine is set free, and one equiv. of chloride of manganese remains.

In the second process the chloride of sodium is decomposed, and one equiv. of oxygen of the manganese combines with the sodium to form soda, setting free one equiv. of chlorine, and the sulphuric acid combines with the soda and protoxide of manganese.

Properties.—It has a greenish colour; a strong smell and taste; is irrespirable; a supporter of combustion; some metals put into it in a finely divided state take fire, forming chlorides; cold water absorbs twice its volume, and yields it again when heated. It has bleaching properties, and is considered to be a disinfecting agent; under a pressure of four atmospheres it may be condensed into a liquid of a yellow colour; electro-negative. Sp. gr. 2·47. 100 cubic inches weigh 76·599 grains. Equiv. 35·5. Symbol, Cl.

Chlorine has a strong affinity for hydrogen, and on this probably depends its bleaching powers. Water is necessary for chlorine to bleach, and it is considered that the chlorine, by uniting with hydrogen, sets the oxygen free, which, by combining with the body, renders it colourless.

It is supposed to disinfect also, by its affinity for hydrogen, decomposing fetid and injurious gases.

COMPOUNDS OF CHLORINE.

Chlorine unites with hydrogen in only one proportion, forming hydrochloric acid gas. This gas can be formed synthetically, that is, by passing electric sparks through a mixture of hydrogen and chlorine; but it is procured most readily by heating liquid hydrochloric acid.

Hydrochloric acid gas is colourless; has a powerful odour and taste; is irrespirable; is not combustible; extinguishes all burning bodies; has an amazing affinity for water, which can absorb 480 times its volume. When the gas escapes into the air, it forms a white cloud, by combining with the moisture and sometimes with ammonia; dissolved in water, it is known as liquid hydrochloric acid. Sp. gr. 1·2695.

Liquid hydrochloric acid should be colourless. It generally derives some colour from the presence of a little nitrous acid, chlorine, or iron; mixed with nitric acid there is a mutual decomposition; the product known as aqua regia, being a mixture of nitrous acid, water, and chlorine. The chlorine disengaged in this manner becomes a solvent of gold. Equiv. 36·5. Symb. HCl.

COMPOUNDS OF CHLORINE AND OXYGEN.

These compounds are five in number, and are as follows:

	Chlorine.	*Oxygen.*	*Equiv.*	*Symbol.*
Hypochlorous acid .	1	1	43·5	ClO
Chlorous acid . .	1	3	59·5	ClO_3
Hypochloric acid .	1	4	67·5	ClO_4
Chloric acid . .	1	5	75·5	ClO_5
Perchloric acid .	1	7	91·5	ClO_7

HYPOCHLOROUS ACID.

This acid now occupies the place of euchlorine, which is ascertained not to be a compound of one chlorine and one oxygen, but a mixture of chlorine with chlorous acid.

Hypochlorous acid is procured by introducing peroxide of mercury with twice its weight of water, into bottles filled with chlorine; both the oxygen and mercury combine with chlorine, forming bichloride of mercury and hypochlorous acid, which, being volatile, is separated from any peroxide and bichloride by careful distillation. This acid is considered to be formed when chlorine is brought in contact with an alkali, as in the case of liquor sodæ chlorinatæ.

Properties.—When dissolved in water it has a feeble yellow colour, and is transparent, with a strong odour, somewhat like chlorine; acts powerfully on the skin, like nitric acid; has strong bleaching qualities; exposed to a diffused daylight it gradually is decomposed and resolved into chlorine and chloric acid; it oxidizes many bodies very readily.

It has been procured by Balard, in the form of gas, and is then of a yellowish-green colour; water rapidly absorbs 100 times its volume of this gas; it explodes by a moderate increase of its temperature.

CHLOROUS ACID.

Chlorous acid may be procured by putting into a flask 3 parts of arsenious acid, 4 parts of chlorate of potash, and 12 of nitric acid, diluted with 4 parts of water. When these are heated together in a water-bath, a greenish-yellow gas rises which is sparingly soluble in water. It combines with bases forming chlorites.

HYPOCHLORIC ACID.

This acid is procured by the action of sulphuric acid on the chlorate of potash; the sulphuric acid, by uniting with the potash, sets free chloric acid, which is resolved into hypochloric acid and oxygen; the oxygen, instead of flying off, combines with undecomposed chlorate of potash, forming a perchlorate, which remains with bisulphate of potash.

Properties.—A gas of rich green colour; very readily absorbed by water, to which it gives its tint; has bleaching properties. It explodes violently, when heated to 212 degrees. It was for some time named peroxide of chlorine. Salts of this compound have not been obtained.

CHLORIC ACID.

This compound is readily obtained by adding to the chlorate of baryta dilute sulphuric acid to saturation; an insoluble sulphate of baryta is precipitated, and chloric acid remains in solution.

Properties.—Reddens vegetable blues; does not bleach, combines with alkalies, forming chlorates; is readily decomposed by bodies having an affinity for oxygen. Its most remarkable combination is that with potash, formerly known as the oxymuriate of potash, which deflagrates like nitre when thrown on the fire; heated to redness in proper vessels it affords pure oxygen, the residual substance being chloride of potassium.

PERCHLORIC ACID.

This acid is procured from the perchlorate of potash, one of the residual salts in the process for obtaining hypochloric acid. Sulphuric acid is added to it, and, by combining with the potash sets free the perchloric acid, which by a heat of nearly 300 degrees is distilled over in vapour, and condenses in a receiver as a colourless liquid. It is much less easily decomposed than the other compounds of oxygen; it may be boiled with sulphuric and hydrochloric acids without change. Its most insoluble compound is with potash, which requires 65 times its weight of water at ordinary temperatures for its solution.

TERCHLORIDE OF NITROGEN.

Chlorine unites with nitrogen in one proportion, forming a very explosive compound of an oily appearance. It explodes alone when heated to the boiling-point of water, and even at common temperatures in contact with combustibles, especially fixed and volatile oils. It is procured most conveniently by making a solution of hydrochlorate of ammonia with hot water, and at a temperature of about 90 degrees inverting a bottle of chlorine over it. The chlorine is dissolved by the fluid, and decomposes the ammonia. In about half an hour yellow globules subside, which are the terchloride of nitrogen. Comp. 3 equiv. Chlorine, 1 nitrogen. Equiv. 120·29. Symbol, $N\,Cl_3$.

This compound of late is suspected to contain hydrogen, and to be thus constituted:

1 nitrogen,
2 hydrogen,
1 chlorine.

Owing to the extreme danger incurred in its analysation, the exact composition of this substance is unknown.

Chlorine combines with carbon in two or three proportions, with sulphur, forming the chlorides of sulphur, and also with phosphorus, boron, silicon, &c.

IODINE.

Iodine is a simple elementary non-metallic body, existing in combination in sea-plants, many shells, &c. The name is derived from ιωδης, *violaceus*, in consequence of the colour of its vapour. It is procured most cheaply from kelp, in which it exists in the form of iodide of sodium and potassium, or from the fluid which remains after the crystallization of the carbonate of soda. This liquid, sometimes named "mother-liquors, or soap-makers' lees," is to be treated with sulphuric acid and peroxide of manganese. In this process an equivalent of oxygen of manganese unites with the sodium or potassium; the iodine is set free, and a sulphate of manganese, with sulphate of soda, or potash, is left in the retort, the heat driving the iodine into the receiver, where it condenses.

Properties.—Solid at ordinary temperatures; has a metallic appearance; an odour-like chlorine; a pungent taste; easily passes into a vapour of a violet colour; stains the skin of a deep reddish-brown colour; is a non-conductor of electricity; a negative-electric; requires 7000 times its volume of water for solution; most soluble in ether and alcohol; has bleaching properties; forms a blue compound with starch which is insoluble in cold water; combines with metals forming iodides or iodurets; with hydrogen it forms hydriodic acid, with oxygen, iodic acid, and probably an oxide and iodous acid; up to the present, these have not been clearly exhibited. Sp. gr. 4·948 (Gay Lussac); sp. gr. of vapour, 8·716; equiv. 127. Symbol, I.

Hydriodic acid may be obtained by passing the vapour of iodine and hydrogen through red-hot porcelain tubes; they unite, and form hydriodic acid; or it may be procured by the action of iodide of phosphorus on water. They are both decomposed. Hydriodic acid gas and phosphoric acid are the products.

Hydriodic acid gas reddens vegetable blues, smells like hydrochloric acid; forms white fumes with atmospheric air; is readily absorbed by water; combines with alkalies forming hydriodates or iodides with water; easily decomposed by bodies which have a strong affinity for either of its elements, as chlorine, oxygen, &c. Equiv. 128.

Iodic acid may be obtained by the action of iodine on nitric acid. It is a white solid; very soluble in water; has strong acid properties, and unites with numerous bases.

Composition:

Iodine	1
Oxygen	5

Equiv. 167. Symbol, IO_5.

Iodine forms compounds with chlorine, nitrogen, phosphorus, sulphur, carbon, and with most of the metals.

Periodic acid has recently been obtained by some German chemists, by acting upon iodate of soda with free soda and chlorine, in which case chloride of sodium is generated, and a periodate of soda of sparing solubility. By dissolving this in very dilute nitric acid, and adding nitrate of silver, exchange of acids takes place, and periodate of silver is formed. This requires to be dissolved repeatedly, and heated, till it becomes an orange-coloured salt. When this is put into cold water it is decomposed, and resolved into free periodic acid in solution, and a sub-periodate of silver. It has powerful acid properties, is permanent in the air, and is affected by other bodies in a very similar manner to perchloric acid.

Composition:

1 iodine 7 oxygen.
Equiv. 183. Symbol, IO_7.

BROMINE.

This substance closely resembles iodine in its properties. It exists in sea water and marine plants, in the form of bromide of magnesium and sodium. It is procured from bittern, the residual liquid after crystallizing the chloride of sodium and sulphate of magnesia, by passing chlorine through it. The chlorine unites with the magnesium or sodium, and bromine is set free. It may be taken up by ether or distilled over into a cool receiver. It may also be obtained from bittern by the assistance of sulphuric acid and binoxide of manganese.

Properties.—A very dark liquid at the ordinary temperature, of an offensive odour, solid and brittle a little below zero. Sp. gr. 2·976; negative-electric; very destructive to animal life; vaporises readily, and requires to be kept under water; soluble in alcohol and ether, most so in the latter; a supporter of combustion; antimony and tin take fire in it, but potassium burns most vividly. Like iodine, it unites with hydrogen and oxygen, and forms compounds with the simple combustibles, metals, &c. Equiv. 80. Symbol, Br.

Like chlorine and iodine, bromine forms acids with oxygen and hydrogen, the former of which is called bromic acid, and contains five equivalents of oxygen. Symb. BrO_5. It is obtained by a process similar to that for chloric acid. The latter, or hydrobromic acid, is composed of one of bromine to one of hydrogen. It is obtained in a similar way to hydriodic acid. Its equivalent is 81. Symbol, HBr.

FLUORINE.

Fluorine has never been obtained in a perfectly isolated state; it is supposed to be a gas of a yellowish-brown colour, with an odour like burnt sugar with chlorine, to which it bears analogy also in many of its properties; has a strong affinity for hydrogen and metals, and is a negative-electric. Equiv. 19.

Its most simple compound is that with hydrogen, forming hydro-fluoric acid.

Hydro-fluoric acid is obtained from fluor spar, acted upon by sulphuric acid. Fluor spar is presumed to be a fluoride of calcium. The water of the sulphuric acid is decomposed, its oxygen combines with the calcium, forming lime, which, with the sulphuric acid, makes sulphate of lime; the hydrogen combines with the fluorine, and passes over into a receiver, where it is condensed. Equiv. 20. Symbol, HF.

Properties.—It is a colourless liquid, at 32°, and may be kept so as high as about 60° in closed vessels; if exposed to the air, it passes into vapour; it is the most corrosive body known; very deleterious to animal life; has the power of dissolving glass; hence it must be kept in metallic vessels; with the glass it forms fluosilicic acid. It has an amazing attraction for water, more so than even sulphuric acid; when combining, they give out a hissing noise, like when a hot iron is put into water.

It forms with boron fluoboric acid, and fluosilicic acid with silicon, which are highly interesting compounds. It forms no compound with oxygen, as far as is at present known.

AMMONIA.

Ammonia, commonly known as the volatile alkali, is a compound of 3 equivalents of hydrogen and 1 of nitrogen.

Its purest state is that of gas; dissolved in water, which can absorb 780 times its volume, it forms liquor ammoniæ.

Ammoniacal gas can be readily obtained by heating liquor ammoniæ.

Properties.—Colourless; has a pungent odour; brought into contact with hydrochloric acid gas, it forms a dense cloud of hydrochlorate of ammonia; irrespirable in its pure form; it extinguishes flame, but is slightly combustible; is generally generated by decomposition of animal matter by heat. The constituent gases of ammonia cannot be made to unite synthetically; its composition is determined by analysis. Sp. gr. of ammoniacal gas, ·589. Equiv. 17. Symbol, NH_3.

AMIDOGEN.

Another compound of hydrogen and nitrogen is supposed to exist, consisting of NH_2, named amidogen: and, according to this idea, ammonia is a compound of amidogen and hydrogen, *alias*, an amide of hydrogen.

According to Dr. Kane of Dublin, the compound resulting from the mixture of solution of ammonia and bichloride of mercury, is chloride of mercury with amide of mercury.

AMMONIUM.

From the close correspondence of the ammoniacal salts with those of potash and soda, some authorities have surmised that ammonia is but a modification of a non-isolable metal called ammonium; and they consider ammonia in combination with one equivalent of water as the oxide of ammonium. In this point of view ammonia in combination must be written $NH_4 + O$, instead of the old way $NH_3 + HO$, and of course the composition of ammonium is NH_4, and its equivalent 18.

According to this view hydrochlorate of ammonia (HCl, NH_3) ought to be called chloride of ammonium, and to be written Cl, NH_4. In the same way the compound formed by sulphuretted hydrogen and ammonia, called hydrosulphate of ammonia, would be considered as sulphuret of ammonium.

One of the greatest supports to the ammonium theory, is the circumstance that ammonia forms a very remarkable amalgam with mercury; but this very shortly afterwards is decomposed spontaneously into ammonia, hydrogen, and mercury. Further particulars on this head may be found in either of the large works on chemistry.

	Symbol.	*Equiv.*
Ammonia	NH_3	17
„ in combination	NH_3, HO	26
Ammonium . . .	NH_4	18
Oxide of ammonium .	NH_4O	26
Amidogen	NH_2	16

COMPOUNDS OF CARBON AND HYDROGEN.

The compounds of carbon and hydrogen are numerous. Those longest known are light carburetted hydrogen, and olefiant gas; to these a long list may be added, for which the reader is referred to comprehensive chemical works.

Light carburetted hydrogen (or firedamp) may be obtained by stirring up the mud of stagnant pools, and collecting it in glass vessels.

Monsieur Dumas has succeeded in procuring it artificially in great abundance by heating together acetate of soda, solid fused potash, and quicklime; the acetic acid is decomposed, yielding carbonic acid and light carburetted hydrogen.

It is generated copiously in coal-mines, and is there known as firedamp; for, when mixed with oxygen or atmospheric air, and a flame is brought in contact, violent explosion takes place. It is irrespirable when pure, extinguishes a lighted taper put into it, but is combustible, the products being carbonic acid and water. Sp. gr. ·559. Its proper name is the dicarburet of hydrogen; its popular names are firedamp, heavy inflammable air, and inflammable air of marshes.

Composition:

Carbon	1
Hydrogen	2

Equiv. 8. Symb. H_2C.

Sir H. Davy's lamp, used by miners to prevent explosion from firedamp, acts by the wire-gauze being a good conductor of heat, carrying off from the flame which approaches it so much of its heat that it is disabled from igniting gases on the outside. But as currents of air sometimes will drive the flame through the wire-gauze, and explode the gas outside, this lamp is not perfectly safe. To remedy this, an improvement has been made of late years, viz., that of surrounding the wire-gauze with glass, excepting at the top and bottom, which is closed by wire-gauze exceedingly fine. This improvement has saved the lives of many persons.

Olefiant gas is obtained from alcohol by acting on it with sulphuric acid; its name is derived from its forming an oil-like fluid with chlorine. Sp. gr. ·981.

Composition:

Carbon	2
Hydrogen	2

Equiv. 14. Symb. H_2C_2.

HYDROSULPHURIC ACID, OR SULPHURETTED HYDROGEN.

This gas is obtained by pouring diluted sulphuric acid on tersulphuret of antimony, or protosulphuret of iron; water is decomposed, the oxygen goes to the metal, which combines with the acid, and the hydrogen with the sulphur escapes in the gaseous form. It is also given out very copiously when hydrochloric acid and tersulphuret of antimony are employed. Double decomposition takes place, and the products are terchloride of antimony, and hydrosulphuric acid gas.

Properties.—Colourless; of a very offensive odour, resembling rotten eggs; irrespirable, and very destructive to animal life; has acid properties; reddens litmus paper; combines with alkalies, forming hydrosulphates or sulphurets; has a strong affinity for metals, tarnishing silver and gold, and is readily known by its powerful effects in blackening the salts of lead. Sp. gr. 1·77.

Composition:

Sulphur	1
Hydrogen	1

Equiv. 17. Symb. HS.

Sulphur combines with hydrogen in another proportion to form persulphuret or persulphide of hydrogen. It is procured by boiling sulphur, lime, and water together. The liquid formed by these is poured into slightly diluted muriatic acid, and a yellow oily fluid subsides, which is the persulphuret of hydrogen.

Properties.—It is decomposed very readily by almost all substances, resolving itself into sulphur and hydrosulphuric acid; it has the odour of the latter, but more feeble. Sp. gr. 1·769. It has no acid reaction on test-papers, and it is very questionable whether it should be called an acid. If it should be so designated, its name is hydro-persulphuric acid.

Composition :

Sulphur . . .	2
Hydrogen . . .	1

Equiv. 33· Symb. $H.S_2$.

The term sulphuret, in imitation of the Continental chemists, is now changed by many of our chemists into the word *sulphide*, which in a few years will be probably in general use.

CYANOGEN.

Cyanogen is a gas composed of carbon and nitrogen, in the proportion of two equivalents of the former, and one of the latter. It is obtained from the bicyanuret of mercury by the application of heat.

Properties.—Colourless ; has a strong pungent odour; extinguishes burning bodies, but is combustible, burning with a purple flame ; is absorbed by water and alcohol ; unites with most elementary substances ; the compounds are called cyanides or cyanurets. Equiv. 26. Symbol, NC_2.

Towards the end of the process for separating the cyanogen from mercury, a brownish substance is deposited in the retort. This, upon careful examination, is found to contain the same elements as cyanogen, and is isomeric with it, although differing widely in its physical qualities. It is named *paracyanogen*. Johnson, who detected this, suggests that the carbonaceous matter left after the slow combustion of vegetable substances, may consist, in a great degree, of paracyanogen. Other compounds of nitrogen and carbon are mentioned by chemists, for which the curious and inquiring chemical student is referred to the more extensive works.

HYDROCYANIC ACID.

This acid may be obtained by mixing together hydrochloric acid and bicyanuret of mercury in a retort ; mutual decomposition takes place, hydrocyanic acid is formed and rises, and bichloride of mercury is left. If it is desirable to obtain the acid as free as possible from water, it is passed over chloride of calcium, and through fragments of lime, to remove any undecomposed hydrochloric acid.

Another plan adopted is to pass hydrosulphuric acid through a tube containing bicyanide of mercury. The sulphur combines with the mercury, and the hydrogen with the cyanogen.

It may also be obtained in a weaker state by the process mentioned in the London Pharmacopœia, or by the addition of tartaric acid to pure and good cyanide of potassium. In this latter case water is decomposed, and bitartrate of potash precipitated.

Pure *prussic acid* is a light volatile fluid, possessing a powerful odour, like peach blossoms. It boils at 80°; unites with water and alcohol in any proportion; is easily decomposed, and more rapidly so if exposed to light; a brownish-black substance, like charcoal being deposited; and ammonia is found in the liquid. It has weak acid properties, for it is even separated from its bases by carbonic acid.

Composition :

1 cyanogen 1 hydrogen.
Equiv. 27.

For the ample details respecting the *ferro-cyanides,* consult the various valuable works on chemistry.

The *ferrocyanide* of *potassium* will be found detailed in the Materia Medica; but there is a substance of similar composition, called *ferridcyanogen,* to which we must allude in this place. It is tribasic, uniting with three of potassium to form large red crystals, which are incorrectly named red ferroprussiate of potash.

The composition of ferridcyanogen is:

$C_{12}\ N_6\ Fe_2$. Symbol, Cfdy.

It will thus be seen that its equivalent is exactly double that of ferrocyanogen.

The *ferridcyanide* of *potassium* is interesting from the fact, that it produces a blue compound with the protosalts of iron, known by the name of Turnbull's Blue.

Sulphocyanogen is the name of a compound formed by two equivalents of sulphur united with one equivalent of cyanogen. It is monobasic, and forms salts with many metals. Its composition is C_2NS_2.

Sulphocyanide of *potassium* is made by mixing ferrocyanide of potassium with sulphur, and heating in an iron pot. The fused mass is treated with water, and the sulphocyanides of potassium and iron are dissolved out. The iron is separated by the addition of the carbonate of potash, and the residual solution will yield sulphocyanide of potassium.

The *sulphocyanide* of *iron* is known by its beautiful red colour.

Sulphocyanogen unites with hydrogen, forming hydrosulphocyanides with many substances.

METALS.

Before proceeding with our short sketch of the metals, it will be as well to notice briefly the leading crystalline forms that their salts assume.

1. The *regular system*, in which there are three axes, all equal, and placed at right angles to each other. Of this the cube, the regular octahedron, and the rhombic dodecahedron, are the leading varieties. The cube is shown well in the iodide of potassium, and the octahedron in the diamond.

2. The second great system is the *square prismatic*, in which all the three angles are right angles; but only two are of equal length. Of this system the right square prism and the right square based octahedron are the leading varieties. To this second order may be referred the ferrocyanide of potassium.

3. The *right prismatic system*, in which all the axes are of different lengths, but all placed at right angles one to the other. To this order belong the right rectangular and right rhombic prisms, the right rectangular based, and right rhombic based octahedra. Examples of this system may be seen in the nitrate and sulphate of potash, and in sulphur, when crystallized from a solution.

4. The *oblique prismatic system*. In this the axes may be all unequal, but two are placed at right angles, and the third inclined to one and perpendicular to the other. The oblique rectangular and oblique rhombic based octahedron are referred to this system. Examples of this system may be seen in the sulphate and carbonate of soda, sulphate of iron, and other salts.

5. The *doubly oblique prismatic system* has three axes, all unequal in length, and oblique to each other, as in the doubly oblique prisms, and the doubly oblique octahedra. Sulphate of copper and quadroxolate of potash illustrate this class.

6. The *rhombohedral system,* in which there exist four axes—three equal and in one plane, each of 60°, the fourth being perpendicular to all. To this belong the regular six-sided prism, as well as the quartz-dodecahedron and the rhombohedron. Nitrate of soda, quartz, and rock crystal give common examples of this form.

Previous to our leaving the subject of crystallography, it may be as well to mention that no absolute rule can be laid down with regard to the formation of regular crystals, for in most instances one or more faces may be so far developed as to materially lessen others, and almost entirely to change the shape of the whole.

TABLE OF CRYSTALLINE FORMS OF THE LEADING SALTS.

Name of Salt.	Symbol.	Water of Cryst.	Crystalline Form.
Bicarbonate of Potash	$KO, CO_2 + HO, CO^2$		Right-rhombic prism.
Nitrate „	KO, NO_5	none.	Six-sided prism, with dihedral summits.
Sulphate „	KO, SO_3	none.	Dodecahedra (quartz).
Bisulphate „	$KO, SO_3 + HO, SO_3$.		Flattened rhombic prisms.
Chlorate „	KO, ClO_5	none.	Flat and scaly.
Chloride of Potassium	K, Cl	none.	Cubic.
Iodide „	K, I	none.	Cubic.
Bromide "	K, Br	none.	Cubic.
Carbonate of Soda	NaO, CO_2	10	Oblique rhombic prism.
Sulphate „	NaO, SO_3	10	„ „
Nitrate „	NaO, NO_5	none.	Rhombohedral.
Phosphate „	$2 NaO, HO, PO_5$	24	Oblique rhombic prisms.
Biborate „	$NaO, 2 BO_3$	10	Six-sided prisms.
Chloride of Sodium	Na, Cl	none.	Cubic.
Sulphate of Ammonia	NH_4, O, SO_3	1	Flattened six-sided prisms.
Nitrate „	NH_4, O, NO_5	none.	Six-sided prisms.
Sulphate of Magnesia	$Mg O, So_3$	7	Right rhombic prisms.
Alum	$KO,SO_3+Al_2O_3,3SO_3$	24	Octahedra.
Sulphate of Iron	FeO, SO_3	7	Oblique octahedron.
„ Zinc	ZnO, SO_3	7	Right rhombic prisms.
„ Copper	CuO, SO_3	5	Doubly oblique octahedra
Acetate of Lead	$PbO, C_4H_3O_3$	3	Prismatic.
Pot. Tart. of Antimony	KO, SbO_3,C_8H_4O	3	Rhombic-based octahedra.
Arsenious Acid	AsO_3	none.	Octahedra.
Nitrate of Silver	AgO, NO_5	none.	Tabular.

The crystals of oxalic acid closely resemble those of sulphate of magnesia and sulphate of zinc, but are derived from an oblique rhombic prism.

The metals longest known and generally received are 41 in number, and are elementary bodies. During the last ten or twelve years 8 new ones are mentioned, viz., Lantanum, Didymium, Erbium, Terbium, Norium, Niobium, Pelopium, and Ruthenium.

Metals are generally heavy, opaque, good conductors of heat and electricity; have a metallic lustre; some of them are very malleable and ductile. They are mostly positive electrics, and appear at the negative pole.

They differ in the products when combined with oxygen: thus, by combining with oxygen, they form oxides, acids, alkalies, alkaline earths, and earths. The metallic bases of the alkalies are three: potassium, sodium, and lithium.

Potassium may be obtained by heating to whiteness fused potash with iron filings in a gun-barrel. At this temperature the iron filings acquire the greatest affinity for oxygen, and attract it, potassium flies off in a state of vapour, and is condensed in a cool receiver containing naphtha. Some chemists employ carbonate of potash, iron filings, and charcoal, which is a less expensive process, but the potassium obtained is not quite so pure.

Properties.—Solid at ordinary temperatures; quite liquid at 150°; brittle when cooled to 32°; lustre somewhat silvery; sp. gr. ·865; a good conductor of heat and electricity. Thrown into water, on which it floats, the water is decomposed, oxygen unites with the metal, and hydrogen is liberated, and takes fire with a portion of potassium. The combustion is either caused by the heat evolved in consequence of the oxygen combining with the potassium, or from the potassuretted hydrogen being so inflammable as to take fire in contact with the atmosphere. This metal must be kept from contact with oxygen, as in naphtha, or in a bottle hermetically sealed. Equiv. 39. Symbol, K (Kalium).

Potassium combines with oxygen in two proportions, forming potash and the peroxide of potassium. The latter is soon decomposed after its formation, being resolved int protoxide and oxygen.

The salts of potash on a platinum wire give a purple colour to flame.

Sodium may be procured from soda by a process similar to that for obtaining potassium. It has a considerable resemblance to potassium, but is rather heavier; sp. gr. ·972. Its action upon water is very powerful, but there is no flame produced. If gum, however, be added to the water, light is frequently emitted. This metal unites with oxygen in two proportions, forming soda, and peroxide of sodium. Equiv. 23. Symbol, Na (Natrium).

The salts of soda give a yellow colour to flame.

Soda may be known from potash by giving no precipitate with tartaric acid, perchloric acid, and bichloride of platinum, each of which throws down precipitates with potash.

Lithium, the metallic base of lithia, was first separated from oxygen, by Sir H. Davy. It has a powerful affinity for oxygen, which is an obstacle to the ready examination of its qualities. Its equivalent is 6·5. It unites with oxygen in only one proportion. It is considered by some to be lighter than potassium, its sp. gr. being only ·500.

Lithia exists in the minerals named petalite, spodumene, lepidolite, and lithion mica. Its properties are closely allied to those of soda and potash. Its neutralizing power is greater, and it forms less soluble compounds with phosphoric and carbonic acid, Its salts impart a red colour to flame on a platinum wire before the blowpipe.

Barium is the base of baryta; the salts of this metal are exceedingly heavy, and have obtained their name from that circumstance. Baryta is usually found in combination with carbonic and sulphuric acids, for which it has a strong affinity. The soluble salts of baryta are very poisonous. There are two oxides of this metal. Equiv. 68·5. Symbol, Ba.

Strontium is the basis of strontia, which very closely resembles baryta. It exists naturally as a carbonate and sulphate; the latter is often accompanied by free sulphur. Its salts are very heavy, and give a red colour to flame: there are two oxides of this metal. Equiv. 43·8. Symbol, Sr.

Calcium, the metallic base of lime, unites with oxygen in two proportions, forming common hydrated protoxide of lime, also known as unslacked lime, and peroxide of calcium. Equiv. 29. Lime has very similar affinities to baryta and strontia, but forms a more soluble compound with sulphuric acid. The most insoluble salt is formed by uniting it with oxalic acid. Another curious fact is, that lime is more soluble in cold than in hot water. Lime exists most abundantly in the form of carbonate or sulphate.

The sulphate requires about 500 times its volume of water for solution, and forms, when dissolved, a very excellent test for oxalic acid.

The carbonate forms marble, lime-stone, and chalk.

The sulphate exists in the state of gypsum, alabaster, and, artificially prepared, constitutes plaster of Paris.

Magnesium was discovered by Sir H. Davy, by means of galvanism, and has since been prepared more largely by the action of potassium upon the chloride of magnesium. This metal is at present known only to combine with oxygen in one proportion. Equiv. 12. Magnesia exists naturally combined with carbonic acid, and sparingly as a hydrate of magnesia, and in sea-water with chlorine and sulphuric acid. It is distinguished from the other alkaline earths, by forming a soluble compound with sulphuric acid. It exists naturally and abundantly as a carbonate in magnesian limestone.

Aluminium is the metallic base of alumina, which is the chief proximate principle of most clays. It is therefore a constituent of various kinds of pottery, in combination with a small portion of water. The ruby and sapphire are almost entirely composed of alumina. Equiv. 13·7. Symbol, Al. This metal has a brilliant lustre, of a tin-white colour, and does not tarnish by exposure to the air. It has been used for many ornamental purposes.

Glucinium, alias Beryllium, is found oxidized in the beryl, euclase, and emerald. Equiv. 14·1. Symbol, G or Be.

Yttrium exists in the mineral called Yttria, found at Ytterby, in Sweden. Equiv. 32·2. Symbol, Y.

Thorinum is the metallic base of the mineral called thorite. Equiv. about 59·6. Symbol, Th.

Zirconium is found in the jargon or zircon of Ceylon, and in the hyacinth. Equiv. 33·6. Symbol, Zr.

Manganese is always found oxidized, from its strong affinity for oxygen. Its compounds with oxygen were stated to be three, but now are said to amount to no less than seven. They are the protoxide, sesquioxide, peroxide, red oxide, varvacite, manganic, and permanganic acids.

Protoxide	MnO	Equiv.	36
Sesquioxide	Mn_2O	„	80
Peroxide	MnO_2	„	44
Red oxide	Mn_3O_4	„	116
Varvacite	Mn_4O_7	„	168
Manganic acid	MnO_3	„	52
Permanganic acid	Mn_2O_7	„	112

The protoxide is of a green colour, and enters into most of the salts of manganese, the sesquioxide is brownish, and the peroxide black. Manganic acid, with potash, forms that singular substance named chameleon mineral, which affords a variety of colours by its solution in water. Equiv. of manganese, 28. Symbol, Mn.

Iron is a very hard tenacious metal; it requires more heat in melting than gold or silver; is capable of being welded; is attracted by the magnet, may be rendered magnetic, which property belongs only to this metal, nickel, and cobalt. Iron exists naturally combined with oxygen or sulphur, forming iron pyrites, red and black oxide of iron; in other forms it is found more sparingly. The oxygen is removed from the ore by carbonaceous substances and heat, or more rapidly by passing hydrogen gas over it in a porcelain tube. Equiv. 28. Symbol, Fe.

The oxides of iron are two, and according to some chemists four; the protoxide is doubtful as to its colour, it exists in the sulphate of iron, which throws down a white precipitate when pure potash is added; but in this, water is present. The peroxide or sesquioxide is of a red-brown colour, existing naturally as hæmatite iron. From both the oxides of iron we have a perfect series of salts, almost equally stable, but the salts of the protoxide are by far the most active as medicines, and may be considered as the proto-salts of the base.

Besides these two we find a third oxide, incapable of forming salts and frequently magnetic. It is called the black oxide, and is supposed to be a mixture of protoxide with peroxide. A fourth compound is now described, viz., *ferric acid*, containing FeO_3. Iron unites with sulphur in several proportions. The compounds are the tetrasulphuret, disulphuret, protosulphuret, sesquisulphuret, and bisulphuret, the last of which is the common iron pyrites of mineralogists. There are three compounds of iron with carbon, viz., plumbago, cast iron, and steel. In the first, a natural product, the iron amounts to from 5 to 10 per cent.; in cast iron the carbon amounts to from 3 to 5; and in steel from 1·25 to 1·75 per cent. The rust on iron railings is usually a mixture of peroxide of iron, carbonate of iron, and ammonia.

Zinc is found naturally as a carbonate named *calamine*, or sulphuret named *blende*. This metal is commonly called spelter. It is sublimed at a white heat, and, if in contact with the air, attracts oxygen, and forms with it, if received on a plate placed over it, the well known philosopher's wool. The oxides of zinc are supposed to be two, the protoxide and peroxide. Zinc melts at about 773. Equiv. 32·6. Symbol, Zn.

Cadmium exists only in sparing quantities, and is found principally in the ores of zinc. In its pure state it resembles tin, but is harder and more tenacious. It is easily distinguished from tin by its ready volatility. Equiv. 56. There is only one known oxide. The sulphuret of cadmium, obtained by passing hydrosulphuric acid through a solution of the salts of cadmium, has a yellowish-orange colour, which might be mistaken for arsenic. It is distinguished readily from sulphuret of arsenicum by being insoluble in pure potash. It has an oxide, which forms a series of salts.

Tin exists naturally in combination with oxygen, and is most abundant in Cornwall. The metal is obtained from it in the forms of block and grain tin. The oxides of tin are the protoxide, sesquioxide, and peroxide. Tin melts at 442°. This metal, with lead, forms *solder;* and with antimony, copper, and bismuth, the best *pewter*. Equiv. 58. Symbol, Sn.

Cobalt is found associated with arsenic, forming arsenical cobalt. The arsenic is removable by heat, and oxide of cobalt or zaffre remains. This, heated with sand and potash, produces smalt. The chloride of cobalt is used under the name of sympathetic ink. Combined with water, it is almost colourless; but deprived of it, turns blue; and green if a little iron or nickel be present. Equiv. 29·5. Symbol, Co.

Nickel is not a very abundant metal; it is a constituent of meteoric iron, and is found associated with copper, arsenic, cobalt, iron, and sulphur. It has, when pure, a white colour, nearly resembling silver; combines with oxygen in two proportions. Equiv. 29·6. Symbol, Ni. Most of the salts of nickel are of a green colour. The great use of nickel in the present day is for the formation of a white alloy called german silver. In this, although the nickel forms only one fifth of the whole, it is sufficient to give a silvery lustre to the mass. The other ingredients are, copper, which forms one half, and zinc, which forms the remaining three tenths of the compound.

Arsenic is sometimes found native, but most commonly associated with cobalt and iron, occasionally with sulphur, forming the yellow arsenic, or orpiment, and realgar. It is particularly known by its volatility, and the phosphuretted or alliaceous odour which it gives out when heated in contact with the air. Equiv. 75. Symbol, As. It combines with oxygen in two proportions, forming arsenious and arsenic acids. The sulphurets of arsenicum are three: the bisulphuret is red, and is named realgar; the tersulphuret or orpiment is yellow; and the pentasulphuret is yellow also. They are all poisonous.

Chromium exists naturally in the form of dichromate of lead and chromate of iron, in which oxide of chromium is mixed with oxide of iron. From this ore it is usually obtained. Equiv. 26·7. Symbol, Cr. It unites with oxygen in four proportions, forming oxide of chromium, sesquioxide, deutoxide, and chromic acid. The latter is interesting, from forming a very good test of the presence of lead, yielding with it a yellow insoluble precipitate.

Vanadium exists in an iron ore of Sweden, and in the vanadiate of lead, which is found in Scotland; with oxygen it forms a protoxide, binoxide, and vanadic acid. Equiv. 68·6. Symbol, V.

Molybdenum is found mostly as a sulphuret, resembling plumbago, also as a molybdate of lead; with oxygen, it forms two oxides and an acid. Equiv. 48. Symbol, Mo.

Tungsten occurs as a tungstate of iron, manganese, or lime. In its pure state it is very heavy, and almost as hard as steel; with oxygen it forms a sesquioxide, binoxide, and tungstic acid. Equiv. 92. Symbol, W (Wolframium).

Columbium, also known as *Tantalum*, discovered as recently as 1801, is met with in minerals, named tantalite and yttrotantalite. It forms, with oxygen, an oxide and columbic acid. Equiv. 184. Symbol, Cm, or according to some, T (Tantalum).

Antimony is found plentifully combined with sulphur, most frequently in acicular crystals. It unites with oxygen in three proportions, forming teroxide, antimonious and antimonic acids. Equiv. 129. Symbol, Sb.

Uranium is found in the mineral named pitchblende, and the beautiful substance named uranite. It forms three compounds with oxygen, viz., the protoxide, deutoxide, and peroxide, which are much used as colours in the manufacture of porcelain. Equiv. 60. Symbol, U.

Cerium exists in cerite and allanite. It has two degrees of oxidation. It is of no particular service in medicine or the arts. Equiv. 46. Symbol, Ce.

Bismuth is found native, or combined with sulphur, arsenic, and oxygen. It unites with oxygen in two proportions. The ternitrate of bismuth is distinguished from other nitrates by water in large quantity decomposing it, throwing down nitrate of bismuth. Equiv. 208. Symbol, Bi. Bismuth melts at a heat of only 500 degrees, and has a very great tendency when cooling to run into crystals. Its colour is greenish-red, not unlike dirty copper.

Titanium is met with, combined with iron, in the mineral called titanite, octahedrite, or anatase, and rutile; with oxygen it forms an oxide and an acid. Equiv. 25. Symbol, Ti.

Tellurium is found associated with silver, lead, and bismuth; with oxygen it forms two compounds, tellurous and telluric acid. Equiv. 64. Symbol, Te.

Copper is found native, but most abundantly oxidised or combined with sulphur, under the name of copper pyrites. There are three oxides of copper, according to the latest chemical researches. The dioxide or red oxide, the black or protoxide, and the superoxide. Copper beaten into leaves takes fire when immersed in chlorine. It is frequently alloyed with other metals; with zinc it forms *brass*, *tombac*, and *pinchbeck;* with tin, *gun-metal*, *bronze*, and *bell-metal;* it is also alloyed with gold and silver in the coin of this realm. Equiv. 31·7 Symbol, Cu. The salts of copper contain the black oxide.

Copper is one of the best conductors of heat and electricity known, and is very considerably used in the construction of the galvanic battery. Exposed to the air it becomes gradually covered with a thin coat of oxide, which preserves it from further decay.

Lead is a very abundant natural product, most commonly found in combination with sulphur, under the name of galena. It is from this ore that nearly all the lead of commerce is obtained. The oxides of lead are generally described as four. These are the di-oxide, protoxide, peroxide, and red oxide.

Dinoxide or suboxide. Pb_2O.
Protoxide or massicot. PbO.
Red lead. Red oxide. Pb_3O_4.
Peroxide. Brown oxide. PbO_2.

The di-oxide is dark-grey, nearly black; protoxide is yellow, and is known by the name of massicot, and, when partially fused, forms litharge. It enters into the acetate of lead. Red lead is supposed to be a mixture of the proto and peroxide. The peroxide of lead is of a puce colour. Lead, alloyed with antimony, is used for printer's types. Equiv. 103·7. Symbol, Pb.

Mercury is seldom found uncombined; it is obtained from cinnabar, a sulphuret of this metal, by heating it with lime, when the products are sulphuret of calcium, sulphate of lime, and metallic mercury. It is the only metal which is fluid at ordinary temperatures. Its freezing point is about 40° below zero, its boiling point 662°, but according to some 680°. It unites with oxygen in two proportions, forming the black protoxide, and red peroxide; with tin it forms an amalgam for looking-glasses, and is used with gold in the process of gilding. Equiv. 100, or according to the old view, 202. A combination of mercury with other metals forms an *amalgam;* a union of other metals without mercury is named an *alloy*.

Silver is found native and combined with some other metals. It is most commonly extracted from the sulphuret, and the ores of lead with silver, by amalgamation and cupellation, for the description of which processes it will be necessary to search in the larger works on chemistry. It is the whitest of the metals, very soft, malleable, and ductile, and an excellent conductor of heat and electricity; it unites with oxygen in three proportions, forming a dioxide, oxide, and superoxide. The oxide alone is of much interest. This oxide has a brownish-black colour. Equiv. 108. Symbol, Ag.

Gold is always found in the metallic state, but sometimes associated with other metals. It is remarkable for its insolubility in pure acids, and is the most ductile and malleable of metals. It is presumed to combine with oxygen in two proportions, forming the protoxide, oxide, and peroxide, or auric acid. Equiv. 197. Symbol, Au (aurum). The chloride of gold forms a beautiful purple compound with the proto-chloride of tin.

Platinum, like gold, is only known to exist in the metallic form. It is found in Peru and the Uralian mountains, often associated with other metals. It is the heaviest of metals, bears the strongest heat of the forge without fusion, and is not acted upon by any pure acid. It is supposed to combine with oxygen in two proportions, forming the protoxide and binoxide. Equiv. 98·7. Symbol, Pl.

Palladium, *Rhodium*, *Iridium*, and *Osmium*, are always found in company with platinum. They exist only in minute quantity, and are of no great interest to the medical man.

The more recently discovered metals are not as yet clearly described, their properties being very difficult to discover owing to the extremely minute quantity in which they have been found. Enough, however, is known to place them in the several groups already alluded to, and which will be found preceding the description of the elementary bodies.

SPECIFIC GRAVITIES OF THE MORE COMMON METALS.

				Lighter than Water.	
Platinum	21·	Cadmium	8·6	Sodium	·972
Gold	19·25	Cobalt	8·5	Potassium	·865
Tungsten	17·6	Nickel	8·3	Lithium ?	·500
Mercury	13·7	Iron	7·8		
Palladium	11·5	Tin	7·3		
Lead	11·35	Zinc	7·		
Silver	10·5	Manganese	6·85		
Bismuth	9·8	Antimony	6·7		
Copper	8·9	Arsenic	6·1		

HEAT OF FUSION OF METALS.

Mercury	39	Silver	1873
Potassium	136	Copper	1996
Sodium	190	Gold	2016
Tin	442	Cast Iron	2786
Bismuth	500	Wrought Ditto	3600
Lead	612	Platinum only fusible by the oxy-hydrogen blowpipe.	
Zinc	773		

ORGANIC CHEMISTRY.

Animal and vegetable bodies are very complicated in their structure, and are formed by a series of compounds named proximate principles, which can be resolved into a small number of simple elements. The chief elements are four, viz., oxygen, hydrogen, carbon, and nitrogen; besides which we occasionally find phosphorus, sulphur, and one or two others.

Organic bodies are very liable to undergo decomposition when deprived of vitality and exposed to moisture and air. Vegetable substances are composed almost entirely of oxygen, hydrogen, and carbon; nitrogen is sometimes present, but in small quantity: so that when decomposed by natural changes they afford carbonic oxide, carbonic acid, water, carburetted hydrogen, and in a few instances ammonia.

Organic bodies are distinguished also by the difficulty, and indeed impossibility, of imitating them by chemical art; and likewise by their undergoing complete decomposition when exposed to red heat.

Vegetables contain numerous compounds, called proximate principles, such as resin, gum, &c. Many of these proximate principles, again, may be combined in a juice of the plant, as in opium, and may exist in one particular portion, or diffused through the plant generally. The numerous proximate principles are found to contain the same elements, but in various proportions. The process adopted to ascertain the proportion of elementary particles is called ultimate analysis. To effect this a quantity of vegetable is put into a vessel with a certain quantity of peroxide of copper, and a sufficient heat is applied to ignite the vegetable substance. The relative quantity of carbon, oxygen, hydrogen, or nitrogen, is deduced from the products. The reason that the oxide of copper is used is, that it never undergoes spontaneous change when exposed by itself to the greatest heat, but that it readily parts with oxygen to any organic substance with which it may be placed in contact. This is one of the most difficult processes in chemical manipulations, and is very elaborately described in Fownes's valuable work on chemistry.

Vegetable substances admit of a classification, according to the relative quantity of oxygen and hydrogen contained in them. If the oxygen to the hydrogen exists in a greater quantity than is sufficient to form water, the substance is generally acid; if the hydrogen predominates over the oxygen, the substance is oily or resinous; if they exist in the proportions to form water, the substance is not acid, oily or resinous, but forms sugar, gum, starch, &c.

The vegetable acids contain oxygen, hydrogen, and carbon, excepting only oxalic acid. Many of these exist in plants ready formed; some are products of the fermentative or other changes.

Acetic acid is found in plants ready formed, in combination with lime or potash, but is commonly produced by acetous fermentation; it is also procured by the destructive distillation of vegetable matter,

This acid combines with numerous bases, forming acetates, which are soluble either in cold or hot water.

Composition of this acid, according to Prout,

$$C_4 H_3 O_3.$$

Oxalic acid is found ready formed in the oxalis acetosella, rumex acetosa, rhubarb, tendrils of the grape, &c.

For commercial purposes it is prepared artificially, by the action of nitric acid on sugar. The nitric acid appears to abstract all the hydrogen from the sugar, substituting the same number of equivalents of oxygen, leaving the elements of the sugar in the proportions to form oxalic acid, which is equal in weight to half the sugar employed. This acid is also generated by the action of nitric acid upon many other organic substances, as gum, starch, &c. The crystallized acid contains three equivalents of water.

Composition :

3 oxygen,
2 carbon,
Symbol, $C_2 O_3$.

Or it may be considered as a compound of carbonic acid and carbonic oxide. By some chemists it is designated a carbonate of the protoxide of carbon, its most modern name is hypocarbonic acid. Some of the salts of oxalic acid are insoluble, others of very sparing solubility in water.

Tartaric acid exists in the grape-juice, and is readily obtained from the tartar of wine-casks after it is purified, by the process recommended in the London Pharmacopœia. This acid is distinguished by its great affinity for potash, which it partly abstracts from every other acid, and by its disposition to form double salts.

Composition of crystallized tartaric acid :

2 hydrogen,
5 oxygen,
4 carbon,
1 water.

In the present day tartaric acid is considered to be bibasic, and in consequence its equivalent has been doubled. In the new point of view its symbol would be C_8, H_4, $O_{10}+2\ HO$. The tartrates of potash, soda and ammonia, are more or less soluble; but the tartrates of lime, baryta, strontia, and magnesia are insoluble. Of the bitartrate of potash but five grains are soluble in one ounce of water.

Citric acid is obtained in greatest purity and quantity from the juice of the lime and lemon, by the processes ordered in Pharmacopœias. Dissolved in water it is liable to be decomposed by keeping. Its salts are called citrates, amongst which the citrate of lime is very insoluble, that of potash is very soluble.

Composition :

5 hydrogen,
11 oxygen,
12 carbon,
3 water.

This acid is tribasic, and consequently forms a series of salts somewhat resembling those of phosphoric acid.

Malic acid is found in many acid fruits, in combination with citric and tartaric acid, as in tamarinds. It is contained in apples, and almost uncombined in the fruit of the Sorbus aucuparia, the wild service tree. It may likewise be procured from the juice of green rhubarb, and by the action of nitric acid on sugar. It is obtained from the juice of the wild service-tree berries by adding acetate of lead, and subsequently sulphuric acid, or hydro-sulphuric acid, by which the malic acid is set free.

The salts of this acid are generally soluble in water.

Composition:

4 hydrogen,
8 oxygen,
8 carbon,
2 water.

This acid, like tartaric, is bibasic.

Benzoic acid exists in benzoin, and in most of the balsams, in combination with resin. It may be obtained either by the application of heat, or by boiling benzoin in water, with carbonate of lime or potash. The benzoate is then decomposed by hydrochloric acid, and benzoic acid separated.

Composition:

5 hydrogen,
3 oxygen,
14 carbon,
1 water.

This acid is remarkable from the great amount of carbon that it contains, as well as from its peculiar taste and aromatic odour. It is almost insoluble in cold water, it is dissolved with a little difficulty in boiling water, but it is freely soluble in alcohol.

Gallic acid is found in many vegetables, and generally associated with tannin. It is obtained in greatest quantity from the gall-nut, but in a pure state with much difficulty. To procure it, an infusion of gall-nuts is to be made, and allowed to stand for several days, during which period crystals of gallic acid are deposited. It is subsequently decolorised by the assistance of charcoal. Pure gallic acid requires 100 parts of cold water for solution. This acid is known by its forming a blue colour with the persalts of iron, and by forming insoluble compounds with metallic oxides; it is distinguished from tannic acid by not forming a precipitate with gelatine. Its composition, according to Fownes, is—

$$H_7OC_3 + 2HO\text{; or, } H_7O_3C_5\text{;}$$

and this forms crystals with one equivalent of water.

Gallic acid is formed by the spontaneous decomposition of tannic acid under the action of water and atmospheric air. In this case oxygen is absorbed, and converts a portion of the carbon and hydrogen into carbonic acid and water; the former of which escapes, whilst the latter (2 equiv.) unites with the gallic acid, of which two equivalents are formed.

Tannic acid or *Tannin* is the principle which gives astringency to most vegetable substances, in which it generally exists with gallic acid. It is contained in large quantity in gall-nuts, kino catechu, and oak-bark. Pure tannic acid is colourless, but is procured in that state with much difficulty. It is soluble in water, ether, and warm alcohol, acquiring a yellow or brown colour when exposed to the air. It is chiefly known by its effects on the salts of iron and gelatine; with the former it forms a dark black compound, which, with gallate of iron, forms the colour of ink; with the latter it forms tanno-gelatine, the basis of leather. An artificial tannin may be obtained by the action of nitric acid on charcoal, and some bituminous substances; also by the action of sulphuric acid on resin, camphor, &c.

The supposed composition is—

$$C_{18}H_5O_9 + 3HO.$$

VEGETABLE ALKALIES.

The vegetable alkalies, or *alkaloids*, as some chemists call them, are the active principles of many vegetables, and are composed of oxygen, hydrogen, nitrogen, and carbon. They exist in combination with some acid which gives them solubility, for in the pure state they are almost insoluble in water, sparingly soluble in cold alcohol, but freely soluble in boiling alcohol. They are all decomposed by great heat, and ammonia is one of the products.

Morphia.—This alkaline principle of opium, in which it exists in combination with meconic acid, codeia, narcotine, resin, &c., may be procured by the process given with the decompositions (p. 32).

Composition :

35 carbon,
20 hydrogen,
6 oxygen,
1 nitrogen.

Morphia, from its insolubility, has very little action on the system; but with acetic, hydrochloric, sulphuric, citric, and other acids, it forms very soluble and energetic compounds.

Codeia, another alkaline constituent of opium, closely resembles morphia. If ammonia be added to the mixed hydrochlorates, morphia will be precipitated and codeia will remain in solution. Codeia is distinguished from morphia by its greater solubility in water, and by not being reddened by nitric acid. In composition it differs from morphia in containing one atom less oxygen.

Meconic acid is most readily procured by adding to a solution of opium acetate of lead or baryta, which causes a precipitate of meconate of lead or baryta. This meconate, treated with sulphuric acid or hydrosulphuric acid, will afford free meconic acid.

Narcotine may be easily obtained by digesting an aqueous extract or solution of opium in sulphuric ether, which dissolves the narcotine, and leaves the meconate of morphia; by evaporation narcotine is left in white crystals.

Composition :

48 carbon,
24 hydrogen,
1 nitrogen,
15 oxygen.

Narcotine is soluble in oil, alcohol, and ether; insoluble in cold water, but sparingly soluble in hot water; acids render it soluble, and this appears to be effected by free meconic acid in opium. It does not possess alkaline properties.

Quinine or *quina*, the alkaline base of the cinchona cordifolia, may be procured by digesting the bark in very dilute sulphuric acid; when lime is added to the solution, a sulphate of lime is formed, and the quina is precipitated. The precipitate is then to be washed with cold alcohol, to remove colouring matter, and afterwards treated with boiling alcohol, which, on cooling and evaporation, leaves the quinine in a white flocculent state. Its composition is—

20 carbon,
12 hydrogen,
1 nitrogen,
2 oxygen.

Cinchonia closely resembles quina in its properties; it is but slightly soluble in water, freely in alcohol, and forms a series of salts with acids. Its composition is—

20 carbon,
12 hydrogen,
1 nitrogen,
1 oxygen.

Strychnia is found in the nux vomica and in the St. Ignatius bean, associated with igasuric acid. It may be obtained by digesting the nux vomica in sulphuric acid, and treating afterwards with lime: strychnia and brucia are both thrown down, and the latter is separated from the former by washing with cold alcohol, in which it is freely soluble.

The composition of strychnia is—

$$C_{44}\,H_{23}\,N_2\,O_4.$$

Of brucia—

$$C_{44}\,H_{25}\,N_2\,O_7.$$

Veratria is obtained from the sabadilla, in a similar way to strychnia; its exact composition is unknown.

Colchicia, the alkaloid that gives its peculiar properties to the colchicum, has been isolated, but its exact composition is unknown.

Conia is obtained from the conium, and nicotine from the tobacco, of which they are the active principles. Both are oily in appearance, and are very poisonous. With acids they form crystallizable salts. Their composition is—

Conia (conicine) .	$C_{16} H_{16} N_2$.
Nicotine . . .	$C_{10} H_8 N$.

The following alkaloids are also known, but their true composition is not yet ascertained:

Aconitine, the	active	principle of	Aconite,
Atropine	,,	,,	Belladonna,
Curarine	,,	,,	The Woorara poison,
Delphinine	,,	,,	Staphysagria,
Daturine	,,	,,	Stramonium,
Emetine	,,	,,	Ipecacuanha,
Hyoscyamia	,,	,,	Hyoscyamus,
Solanine	,,	,,	Dulcamara.

To these may be added the following, which are analogous in properties, though not strictly vegetable alkalies:

Asparagine, obtained	from	the	Asparagus .	$C_8 H_8 N_2 O_6$
Caffeine or theine	,,	,,	Coffee, tea, &c.	$C_8 H_5 N_2 O_2$
Picrotoxine	,,	,,	Cocculus Indicus	$C_{12} H_7 O_5$
Theobromine	,,	,,	Cacao . .	$C_{14} H_8 N_4 O_4$.

And several others—such as gentianine, elaterine, daphnine, piperine, and bebeerine; of which the composition is not yet satisfactorily known.

Oils are liquids having an unctuous feel; insoluble in water, and inflammable, the chief products of their combustion being carbonic acid and water. They are compounds of oxygen, hydrogen, and carbon, and may be divided into fixed and volatile.

The *fixed oils* are procured from the seeds of plants, or the pulpy covering, as in the olive, by pressure, in the case of the vegetable oils, or from the fat-cells of animals by heat. They vary much in solidity; are all lighter than water; do not possess much colour; leave a greasy stain on paper; are volatilized with great difficulty, requiring a temperature of 600° for ebullition, and are even then partially decomposed; exposed to the air they absorb oxygen, become rancid, and acquire a property of drying; hence they are used for paint and varnishes; with oxide of lead they form plasters, and with the alkalies they form soaps.

Vegetable oils are found to contain two proximate principles, named margarine and oleine: the former is the more solid portion; the oleine is the most fluid part. Animal oils, in addition, contain a third principle, called stearine, which is still more solid than margarine. When an alkali is added to the oils, it is considered by Chevreul, and chemists generally, that these proximate principles are decomposed, and resolved into glycerine, and margaric, stearic, and oleic acids, which latter combine with the alkali, and glycerine remains liquid. Such is the theory of the formation of *soap.*

The composition of these substances is as follows :

Stearic acid	$C_{68} H_{66} O_5, 2 HO$
Margaric acid	$C_{34} H_{33} O_3 \cdot HO$
Oleic acid	$C_{44} H_{39} O_4 \cdot HO$
Glycerine	$C_6 H_8 O_6$.

In the palm oil exists a peculiar acid, called the palmitic; in the cocoa-nut oil cocinic acid; and in the expressed oil of the nutmeg myristic acid. They all closely resemble margaric acid in composition and properties, and their composition is—

Palmitic acid	$C_{32} H_{31} O_3$
Cocinic acid	$C_{27} H_{26} O_3$
Myristic acid	$C_{28} H_{27} O_3$.

Succinic acid is the peculiar acid procured from the distillation of amber. It is soluble in water and alcohol. Its composition is—

$$C_4 H_2 O_3.$$

In butter are contained four acids—the butyric, caproic, caprylic, and capric; the first, alone, is of importance. Its formula is—

$$C_8 H_7 O_3 \cdot HO.$$

In the bile is found a peculiar fatty substance, *cholesterine,* which forms the great mass of biliary calculi. It is insoluble in water, soluble in alcohol and ether; at 280 it melts. It is procured by heating powdered gall-stones in strong alcohol, and leaving it to crystallize as the solution cools. Its composition is—

$$C_{36} H_{32} O.$$

The active principle of the Spanish-fly is a peculiar fatty substance, called cantharadine. It is extracted from the *Cantharis vesicatoria* by ether, and crystallized from the solution. It is volatile when heated. The composition is—

$$C_{10} H_6 O_4.$$

Spermaceti is a peculiar matter, found in large cavities in the head of the *Physeter macrocephalus*. It is semifluid at first, but by cooling, time, and pressure, it is resolvable into a thin, fluid oil, and a larger quantity of the ordinary spermaceti; it is insoluble in water; slightly soluble in alcohol, but freely in ether. Its composition is—

$$C_{64} H_{66} O_4.$$

Castor oil is distinguished from the other ordinary fixed oils, by its being soluble in rectified spirit. By the action of nitric acid there is obtained from it a peculiar, volatile, fatty acid, called œnanthylic.

There are several other oily acids which have not been mentioned, as they have no relation with medicine, nor is there anything very certain known about their composition or properties.

The *volatile* oils are obtained from many parts of plants by distillation. They vary much in specific gravity, some few being heavier than water. The oils heavier than water are those of cinnamon, sassafras, cloves, and pimenta. They differ also in their colour; do not leave a greasy stain on paper; are easily volatilized; are freely soluble in ether and in alcohol; do not form distinct soaps with alkalies; exposed to the air they become thick, and acquire an appearance and properties like resin. The strong acids act on them with much violence, sometimes with the production of flame.

The first class of essential oils is that the members of which are composed only of carbon and hydrogen.

Oil of turpentine is, when pure, a thin, colourless liquid, boiling at 310 degrees. Its specific gravity is ·865; its vapour is 4½ times as heavy as atmospheric air. With heated strong nitric acid it bursts into flame.

Composition:

$$C_5 H_4.$$

With hydrochloric acid gas, the oil of turpentine forms a peculiar solid substance, called artificial camphor, which appears to be composed of one equivalent of hydrochloric acid united to four of oil of turpentine.

Composition of artificial camphor:

$$C_{20} H_{17} Cl; \text{ or, } C_{20} H_{16}, HCl.$$

Oil of lemons is similar in composition to (or isomeric with) oil of turpentine, and also forms an artificial camphor with hydrochloric acid, of which the composition is—

$$C_{10} H_8, HCl.$$

The oils of orange peel (ol. neroli), the oil of bergamot, the oil of juniper, and the oils of capivi, cubebs, and pepper, are all isomeric with the oil of turpentine.

The second class of volatile oils contains those that have oxygen in their composition. The oil of aniseed, that of bitter almonds, cummin, and cinnamon, as well as those of valerian, peppermint, lavender, rose, orange, and rosemary, belong to this class.

Oil of aniseed	$C_{20} H_{12} O_2$
Oil of cinnamon	$C_{18} H_8 O_2$
Oil of bitter almonds . .	$C_{14} H_6 O_2$.

The third class of essential oils is formed by those that contain sulphur. They are all distinguished by a strong, disagreeable odour; the oil of mustard has the power of vesicating the skin. To this class belong the oils of assafœtida, hops, garlic, mustard, and onions.

Oil of mustard	$C_8 H NS_2$
Oil of garlic	$C_6 H_5 S$.

Camphor is a substance, *sui generis*, intermediate between volatile oils and resins. It contains a large quantity of carbon, is soluble in spirit, fixed and volatile oils, and strong acetic acid, but very sparingly in water. It melts when heated and at a higher temperature boils. It sublimes easily, and is somewhat volatile at ordinary temperatures. Its composition is $C_{10}H_8O$. With two equivalents of oxygen and one of water, it forms camphoric acid. Another variety of camphor is found in the Dryobalanops camphora, of which the composition is $C_{10}H_9O$. It is brought from Borneo.

Resins are juices of plants, which, when dry, are hard and brittle, and often of a yellow colour; they are soluble in alcohol, ether, alkalies, and oils, but quite insoluble in water. Hence water, mixed with a spirituous solution of resin, by combining with the alcohol, precipitates or sets free the resin. They contain a large quantity of carbon and hydrogen; by combustion they yield carbonic acid and water, and likewise a quantity of charcoal, which is named lampblack.

Amber is supposed to be a fossil resin. It is composed of bituminous matter (insoluble both in ether and alcohol), resin, succinic acid, and a volatile oil.

Balsams are ordinarily compounds of benzoic or cinnamic acid and resin, either in a solid or fluid state. The balsam of copaiba, however, contains no benzoic acid, nor does Canada balsam nor the substance called Venice turpentine which belongs to the same class.

Gum-resins are juices of plants in which resin and gum are combined with a little essential oil and extractive matter, consequently they are most soluble in proof spirit. They afford many active medicines.

Caoutchouc, ordinarily known as Indian rubber, is an exudation from several trees growing in Asia and America. It is very inflammable, insoluble in water or alcohol, but is soluble in essential oils; slightly in pure ether, but most so in naphtha or petroleum. It is sparingly dissolved by the alkalies, and decomposed by sulphuric and nitric acids. It is a hydro-carbon as far as is known: gutta percha is a similar substance, but is far less elastic. It is soluble in naphtha, chloroform, &c.

Wax is of vegetable origin. It is solid at ordinary temperatures; melts at 150 degrees: exposed to red heat is decomposed, forming products like those of fixed oils; insoluble in water; slightly soluble in hot ether and alcohol; miscible with fixed and volatile oils, and with resins; composed of two proximate principles, *cerin* and *myricin*, and with alkalies forms a somewhat saponaceous compound.

Bitumens are substances chiefly composed of carbon and hydrogen. They are very inflammable, producing by their combustion carbonic acid and water: they are naphtha, petroleum, bitumen, mineral tar and pitch, asphaltum, retinasphaltum, and the many varieties of coal.

Naphtha, a rock oil, is used to preserve potassium, as it contains no oxygen.

Some varieties of coal contain, besides the elements mentioned, oxygen and nitrogen, so that, when subjected to a red heat in close vessels, they afford coal tar, gaseous compounds of carbon with hydrogen, acetic acid, water, sulphuretted hydrogen, carbonic acid, sulphurous acid, and ammonia; *coke* being the solid residue. Reichenbac has discovered in coal tar six interesting combustible principles, they are paraffine, eupione, pittakal, picamar, kapnomor, and creosote.

We shall next proceed with the chemistry of the non-azotized, saccharine, and amylaceous bodies, and of the substances formed by their decomposition:

Sugar is a product of the saccharine fermentation, but is procured most abundantly from the juice of the sugar-cane, in which it exists in very large quantity; mixed with yeast, and heat being applied, it is decomposed, and alcohol is the product of the action, which is commonly known as vinous fermentation. It is a compound of nearly equal elements of oxygen, hydrogen, and carbon.

In addition to cane sugar there are several other varieties of sugar, and some proximate principles isomeric with it. Their relations are evident from the following tabular comparison:

		Carb.	*Hyd.*	*Oxy.*
Cane sugar, crystallized . .	contains	24	22	22
Grape " "	"	24	28	28
Milk " "	"	24	24	24
Starch, dried at 212 . . .	"	24	20	20
Amidine, or gelatinous starch .	"	24	20	20
Dextrine, or gummy starch . .	"	24	20	20
Gum acacia	"	24	22	22
Gum tragacanth	"	24	20	20
Lignine, or cellulose . . .	"	24	20	20
Caramel, obtained by heating sugar	"	24	18	18

In combination cane sugar is found to lose four equivalents of water; grape sugar seven; and milk sugar five.

Grape-sugar is contained in fruits generally, and is also found in diabetic sugar, it may be obtained from starch, cane-sugar, and dextrine. It is distinguished from cane-sugar by being less sweet; less soluble is water, does not form regular crystals, but concretes in watery granular masses, and is not blackened by sulphuric acid.

Starch is a proximate vegetable principle, often found in the seeds and other parts of plants. It may be procured from wheat-flour by making a paste and inclosing it in linen, and letting a stream of water run over it; the gluten is left, and the starch is removed and falls down in the water, from which it is separated in the solid state by evaporation. It may be procured by a similar process from potatoes.

Starch under the microscope appears to consist of granules, of a rounded or oval form, presenting an appearance, on the surface, of a number of circular rings; the starch itself seeming to be contained in a thin case, which, by boiling, gives way, bursts, and is distributed through the liquid.

Starch is particularly characterised by forming a dense blue compound with a solution of iodine. It is insoluble in cold water; soluble in hot water, which, on cooling, still keeps it suspended. Its constituents are like those of sugar, and may be considered nearly isomeric with it. Under the action of almost any acid it becomes changed into the next compound.

Dextrine, so named from its action on polarized light, turning the ray to the right hand, may be obtained by heating gelatinous starch with dilute acids, sulphuric, hydrochloric, and many others; it is also formed during the germination of seeds, an azotized principle named *diastase*, existing or developed in them, being the means of the conversion of the starch into dextrine. Dextrine is very like gum, soluble in water; insoluble in spirit, and with iodine sometimes forms a purplish-red colour.

Inuline, obtained from the root of Inula helenium (elecampane), bears some resemblance to starch, but is not precipitated by acetate of lead or infusion of galls; with iodine it forms a brown colour.

Composition:

$$C_{24} H_{28} O_{21}.$$

Gum is the principle which is found almost pure in gum arabic, and which, when dissolved in water, forms a viscid clammy liquid, called mucilage. It is soluble in cold or hot water, in which its solubility is increased by acids and alkalies; it is insoluble in alcohol and ether, which precipitate it; it is also thrown down by the diacetate of lead, as well as by several other metallic salts. Boiled with four times its weight of nitric acid it forms mucic acid; by strong sulphuric acid it is decomposed, giving rise to the formation of acetic acid, water, and charcoal.

Gum tragacanth is principally composed of a substance called bassorine, which does not dissolve in but merely forms a mucilage with water. It is, however, soluble in caustic alkalies.

Cerasine forms the insoluble portion of cherry-tree gum. In its properties it resembles bassorine.

Pectine, the gelatinous portion of fruits, is similar in properties to the last mentioned. Symbol, $C_{16} H_{12} O_{16}$.

Lignine, or *cellulose*, which constitutes the bulk of all kinds of wood, and the more solid parts of most plants, is composed of oxygen, hydrogen, and carbon. It is insoluble in water or alcohol, and undergoes no change by keeping. Boiled with strong sulphuric acid it is converted into dextrine, which by long boiling is converted into saccharine matter, like that from grapes; nitric acid decomposes lignin, forming malic, oxalic, and acetic acids.

By the action of nitric acid on sugar or starch, oxalic acid is formed, a short description of which will be found among the vegetable acids.

By the action of strong nitric and sulphuric acids on cotton wool, a most interesting substance is formed, called pyroxyline (or gun cotton), of most explosive properties. It burns, like gunpowder, without the necessity of a free access of air, and leaves no solid residue. Its chemical composition is supposed to be $C_{24} H_{18} N_{5} O_{40}$.

By the action of dilute nitric acid on sugar, is formed saccharic acid; by its action on gum, is formed mucic acid; and by its action on cork, is formed suberic acid; all of which compounds are interesting, but scarcely admissible into an elementary treatise on chemistry.

FERMENTATION.

It is almost impossible to give a correct definition of the process of change to which this term is applied. It may in a general way be considered as the change (under the stimulus of a ferment) of a highly complicated organic substance into a series of organic products, decreasing in intricacy of composition, and finally terminating in the entire destruction of the product.

Thus, starch becomes converted into grape-sugar, constituting what is called the saccharine fermentation; this sugar in its turn becoming alcohol, forming the second stage of fermentation, or the vinous; the alcohol, by further decomposition, resolves itself into acetic acid, making the third stage, or acetous fermentation; and this vinegar in its turn is finally decomposed into carbonic acid and water —this last constituting the fourth stage, or putrefactive fermentation.

In the *saccharine fermentation* (well seen in the manufacture of malt) the starch of the bruised grain is converted into sugar by the action of a peculiar substance called diastase, formed during the partial germination of the seed. In the conversion of grain into malt, four processes are necessary: 1. Steeping, the grain being put into water until it becomes soft and swollen. 2. Couching, or putting it into a heap, so as to increase the fermentation by elevating the temperature. 3. Flooring, that is, spreading it on the ground so as to prevent destructive heat. And, lastly, kiln-drying, to check the further progress of germination.

The saccharine fermentation requires the presence of starch, and a certain amount of heat and moisture, for its perfection. It is favoured by the access of atmospheric air, and the exclusion of light. During its progress much carbonic acid is evolved.

In the *vinous fermentation*, the sugar, the equivalent of which (for it is grape-sugar that we use, cane-sugar becoming converted into it during the process) is $C_{24}\ H_{28}\ O_{28}$, is resolved into four of alcohol ($4\ C_4\ H_6\ O_2$), eight of carbonic acid ($8\ Co_2$), and four of water.

Thus 4 of alcohol	$C_{16}H_{24}O_8$
8 of carbonic acid	$C_8 \cdot O_{16}$
4 of water	H_4O_4
One equivalent of sugar	$C_{24}H_{28}O_{28}$

The vinous fermentation requires for its fulfilment sugar, water, and some azotized substance, such as yeast, and a certain temperature (about 80° F. is best).

The theory of the action of ferments is not thoroughly understood; it may, however, be considered that they all belong to the nitrogenized substances, and that the species of fermentation they excite varies with the state of decomposition in which they may be themselves, and that the substances they occasion to be formed are, as a general rule, simpler in composition, and more permanent in their properties, than the original bodies which have been decomposed.

One of the products of the decomposition of sugar is lactic acid. Its composition is $C_6H_5O_5 + HO$. It unites with several alkalies forming lactates, the latter equivalent of water being supplied by one of the base.

The change of alcohol into vinegar, or the acetous fermentation, is occasioned by the former losing two equivalents of hydrogen and absorbing two of oxygen. Thus from alcohol, $C_4H_6O_2$, is formed acetic acid, $C_4H_3O_3 + HO$.

The acetous fermentation may be also said to consist of the oxidation of alcohol. Each atom of alcohol exposed to the air absorbs 4 equivalents of oxygen and by the union is resolved into one equivalent of acetic acid and three equivalents of water, thus:

$$C_4H_6O_2 + O_4 = C_4H_3O_3,\ 3\ HO.$$

The requisites for the acetous fermentation are alcohol, access of atmospheric air, and the presence of a ferment. Acetic acid may be rapidly formed by pouring strong spirit upon wood-shavings in a state of cremacausis and in contact with the air. In a few minutes the change will take place.

Putrefactive fermentation is that change by means of which vinegar and most other substances are separated into the simplest combinations of organic chemistry. Acetic acid, by absorption of oxygen, becomes converted into carbonic acid and water. Thus,

$$\begin{array}{r} C_4\,H_3\,O \\ O_8 \\ \hline \text{Form } 4\,CO_2 + 3\,HO. \end{array}$$

By the putrefactive decomposition of azotized substances, are formed carburetted hydrogen, sulphuretted hydrogen, cyanogen and ammonia; and sometimes free hydrogen or nitrogen are evolved, as well as the carbonic acid and water already mentioned.

On the addition of sulphuric acid to alcohol, and the application of heat, a light volatile liquid called æther distils over. Its formula is $C_4\,H_5\,O$; which shows it to be formed by the abstraction of an equivalent of oxygen, and one of hydrogen from an equivalent of alcohol. The reactions involved in the process, will be found described among the decompositions of the Pharmacopœia.

Æther has been supposed to be the oxide of a non-isolable organic base, called ethule, or ethyle. The æthule compounds are numerous and interesting; the principal are—

Ethule	$C_4\,H_5$
Æther (oxide of ethule)	$C_4\,H_5\,O$
Hydrochloric æther (chloride of ethule) .	$C_4\,H_5\,Cl$
Hydriodic æther (iodide of ethule) . . .	$C_4\,H_5\,I$
Hydrocyanic æther (cyanide of ethule) .	$C_4\,H_5\,C_2\,N$
Alcohol (hydrate of the oxide of ethule) .	$C_4\,H_6\,O_2$.
Hyponitrite of ether (commonly called nitric æther)	$C_4\,H_5\,O, NO_3$

Besides several others, which may be found in works on organic chemistry.

A similar set of compounds exists, the base of which, and the oxide of that base, are both unknown; but the hydrate is a highly interesting compound, called aldehyde. These are the acetyle compounds, and to them belongs acetic acid.

Acetyle (hypothetical)	$C_4\,H_3$
Oxide of acetyle „	$C_4\,H_3\,O$
Hydrate of acetyle (aldehyde) . . .	$C_4\,H_3\,O + HO$
Aldehydic acid	$C_4\,H_3\,O_2 + HO$
Acetic acid	$C_4\,H_3\,O_3 + HO$.

These compounds are all among the results of the oxidation of alcohol, and will be found fully described in Fownes's 'Chemistry.'

Another of these interesting organic bases is found in a peculiar compound, called kakodyle. This base, the composition of which is C_4H_6As, unlike æthule and acetyle, is isolable, and has a complete series of combinations in exactly the same way as the bases already mentioned.

In the spirit obtained by the destructive distillation of wood, has been found another organic basis, called methule, which also forms a complete series of compounds, of which the following are the most striking members:

Methule (unknown)	C_2H_3
Oxide of methule	C_2H_3O
Chloride of methule	C_2H_3Cl
Iodide of methule	C_2H_3I
Wood-spirit	$C_2H_3O + HO$
Formic acid	C_2HO_3.

Formic acid (which is so named because it used to be obtained by the distillation of ants with water) is generally made by the oxidation of wood-spirit by finely divided platinum. Two equivalents of hydrogen are given off, and two of oxygen absorbed.

There are several other cheaper ways of obtaining a dilute formic acid.

Formic acid is by some considered to be the teroxide of an organic base called formyle, of which the formula is C_2H.

The substitution of three equivalents of chlorine for the three of oxygen of formic acid, gives rise to the peculiar fluid called chloroform, which is of course the perchloride of formyle. This fluid may be prepared by a variety of processes; the one most generally adopted will be found among the decompositions of the Pharmacopœia.

An iodide and a bromide of formyle also exist; the former is solid, the latter a fluid-like chloroform.

A similar series of compounds also exists, of which the base is called amyle. To it belong the potato-oil ($C_{10}H_{11}O + HO$), which is its hydrated oxide, and valerianic acid. This substance bears about the same relation to potato-oil that acetic acid does to alcohol, or formic acid to wood-spirit, two equivalents of hydrogen being given off, and two of oxygen absorbed. Its formula is—

$$C_{10}H_9O_3.$$

Valerianic acid is obtained for use by several ingenious processes, the description of which will be found in most works on practical chemistry.

In the volatile oil of bitter almonds has been discovered to exist a non-isolable base, called benzule, of which the oil is the hydruret. This base with oxygen forms benzoic acid, to which we have already alluded, and unites with chlorine, iodine, bromine, and sulphur, forming interesting compounds with each.

Benzule (hypothetical)	$C_{14}\ H_5\ O_2$
Oxide of benzule (benzoic acid) . .	$C_{14}\ H_5\ O_2 + O$
Chloride of benzule	$C_{14}\ H_5\ O_2 + Cl$
Hydruret of benzule (bitter almond oil) .	$C_{14}\ H_5\ O_2 + H.$

And in the same way for the other combinations.

Salicine is a crystallizable bitter principle, found in the leaves and young bark of the plants of the willow tribe. By its decomposition with sulphuric acid and the bichromate of potash, is formed a peculiar volatile oil, the hydruret of a hypothetical base called salicyle, of which the formula is

$$C_{14}H_5O_4.$$

In addition to the compound with hydrogen already mentioned, salicyle forms permanent and isolable substances with oxygen, iodine, and bromine.

In the same way as the essential oil of almonds, is the hydruret of the base benzule, so the oil of cinnamon is the hydruret of the base cinnamule, which is also hypothetical, not having been as yet isolated.

Cinnamule	$C_{18}\ H_7\ O_2$
Hydruret of cinnamule	$C_{18}\ H_7\ O_2 + H$
Cinnamic acid	$C_{18}\ H_7\ O_2 + O$
Chloride of cinnamule	$C_{18}\ H_7\ O_2 + Cl.$

ORGANIC COLOURING MATTERS.

Indigo is obtained from the juice of several plants of hot climates, to which the name Indigoferæ has been given. It is produced by the oxidation of the substance which exists in solution, but which finally turns blue, and is precipitated. Neither alcohol, water, oils, weak acids, nor alkalies, will dissolve it; it is, however, soluble in strong oil of vitriol, and then forms a peculiar acid, called the sulphindylic. The composition of indigo is—

$$C_{16} H_5 NO_2.$$

It is bleached by chlorine.

Litmus is a peculiar colouring matter extracted from the Roccella tinctoria, or turnsol, a lichen growing in the Canary Islands, as well as in several other localities. Exposed to the action of ammonia or other alkalies, it gives a blue solution, which is rendered red by the addition of any acid. Reddened litmus paper forms a very delicate test of the presence of alkalies.

The colouring matter of lichens appears to be a substance called lecanorine, the composition of which is the following:

$$C_8 H_8 O_8.$$

Cochineal is an uncrystallizable red principle extracted from the body of the Coccus cacti, an insect found in Central America. From this solution carmine is thrown down by the addition of alumina and oxide of tin. The composition of cochineal is—

$$C_{14} H_7 O_8.$$

Madder is obtained from the root of the Rubia tinctorum. It is a valuable pink colouring matter, and very permanent. Its peculiar colouring principle is called alizarine, of which the formula is—

$$C_4 H_5 O_4 + 3 HO.$$

Turmeric is the yellow colouring matter, obtained by macerating the root of the Curcuma longa in water. Paper dipped in this solution is of a bright yellow colour, but turns brown on the addition of an alkali.

Among the other red colouring matters, may be mentioned logwood and pterocarpus; and among the yellow, saffron, fustic wood and Indian yellow; but a full consideration of their composition would exceed the space that can be afforded.

ANIMAL CHEMISTRY.

All animal matter is composed of a number of proximate principles, which consist chiefly of four elements, viz., oxygen, hydrogen, nitrogen, and carbon. The components of the animal body are now generally divided into azotized and non-azotized. To the former class belong the most essential constituents; the latter comprising the matters which are, as it would appear, only laid up for a future consumption or secreted for present use. Foremost among the azotized substances are the compounds of a base named *proteine.* This, with a variable quantity of sulphur or phosphorus, forms three substances, of which a very large part of the body is composed—these are albumen, fibrine, and caseine. The four elements composing proteine exist in the same proportion as in its compounds; a binoxide and tritoxide of proteine are formed by the action of air and boiling water upon coagulated albumen or fibrine. The former is soluble in water, the latter not. Proteine is supposed also to combine with chlorine. The atomic composition of proteine is stated as follows by Dr. Fownes:

$$C_{400}H_{310}N_{50}O_{120}.$$

Composition of the proteine compounds:

Albumen	$C_{400}H_{310}N_{50}O_{120}PS_2$
Fibrine	$C_{400}H_{310}N_{50}O_{120}PS$
Caseine	$C_{400}H_{310}N_{50}O_{120}S.$

Proteine is procured from a solution of albumen in caustic alkali, which is digested at a temperature of about 140°, and then treated with a little acetic acid. A white precipitate falls, which is proteine. It is soluble in alkalies, and its properties resemble caseine. It is soluble in acetic acid. Proteine may be procured from fibrine or caseine by a similar process to the one with albumen. Its composition per cent. is the following—

Carbon	55·44
Hydrogen	6·95
Nitrogen	16·05
Oxygen	21·56
	100

Albumen.—This exists naturally in great abundance in the blood, and in the white of egg in a soluble state, its solubility being supposed to be owing to a small quantity of soda with which it is in combination; exposed to a heat of 157° F. it coagulates, forming an opaque insoluble mass; its atomic composition, however, appearing to remain unchanged. A precipitate is also given by acids, owing probably to subtraction of the alkali, which appears to possess no slight power of redissolving it when added again. Albumen also combines with many metallic salts, such as those of copper, lead, and mercury; it forms precipitates with sulphuric, hydrochloric, nitric, and metaphosphoric acids; but not with acetic or common phosphoric acid. Tannic acid or infusion of galls, and alcohol, produce precipitates.

The composition in 100 parts is supposed to be—

Carbon	54·84
Hydrogen	7·09
Nitrogen	15·83
Oxygen	21·23
Phosphorus	·33
Sulphur	·68
	100

The existence of sulphur is shown by the black colour given to a silver spoon by an egg, as also by the odour of sulphuretted hydrogen evolved during decomposition.

Fibrine.—This is found in the body in two states—fluid in the blood, solid in the muscles; the latter, when well washed, affords fibrine, though in an impure state, mixed with membrane, nervous matter, and fat. It may be separated from the blood either by agitation with a stick, during coagulation, or by washing the clot after coagulation with water and ether. Fibrine possesses the property of spontaneously coagulating when removed from the body. It is this that partly causes the coagulation of the blood. Fibrine is also coagulated by heat, alcohol, corrosive sublimate, &c.; but is known from albumen by forming a precipitate with common phosphoric acid. Its composition in 100 parts is the following, according to Mulder:

Carbon	54·46
Hydrogen	6·90
Nitrogen	15·72
Oxygen	22·23
Phosphorus	·33
Sulphur	·36
	100

Caseine differs but little from albumen, being like it precipitated by the metallic salts. It is, however, known from it by yielding a precipitate with acetic acid, and when heated shrivelling to a translucent mass. It exists in large quantity in milk, from which it may be separated by sulphuric acid and alkalies, alternately precipitating, redissolving, and filtering it until pure. It is coagulated also by animal membranes, and on this properly depends the formation of cheese. The precipitant in this case appears to be an acid readily formed under such circumstances, named lactic acid.

Composition of caseine, according to Mulder, in 100 parts:

Carbon	54·96
Hydrogen	7·15
Nitrogen	15·80
Oxygen	21·73
Sulphur	·36
	100

Gelatine is found in the skin, tendons, cartilages, membranes, and bones, and in its purest state in isinglass. It does not exist in the healthy fluids of the body.

Properties.—It is very soluble in warm water, becoming somewhat solid on cooling, forms a brittle mass when the water is expelled, as in glue; insoluble in alcohol, miscible with or soluble in weak acids and alkalies, has a feeble affinity for metallic oxides, forms a dense precipitate with tannin, called tanno-gelatine, which is the basis of leather.

Its atomic composition is—

$$C_{13}\,H_{16}\,N_2\,O_5.$$

and in 100 parts—

Carbon	50·45
Hydrogen	6·07
Nitrogen	18·35
Oxygen	25·13
	100

It therefore has no immediate relation with the proteine compounds.

The cartilages of the ribs and joints yield a substance but very slightly different from gelatine, from which, however, it is known by giving a precipitate with acetate of lead and alum. It is called chondrine. Its formula is—

$$C_{16}\,H_{13}\,N_4\,O_7.$$

Hæmatosine is the name given to the colouring matter of the blood. This differs but little from the proteine compounds, except that it contains oxide of iron. According to some chemists the colour of the blood is owing to this substance; but probably the supposition is incorrect, inasmuch as certain animals have iron in their blood though it is colourless; the iron also can be abstracted and the colour remain; and, lastly, the small quantity of iron existing in the fluid would be insufficient to account for the effect. The iron has also been supposed to be the cause of the change of colour, which occurs on the blood being exposed to oxygen, whether in the lungs or when drawn from a vein; but this is hardly based on sufficient grounds. In a hundred parts *hæmatosine* contains—

Carbon	66·49
Hydrogen	5·30
Nitrogen	10·50
Oxygen	11·05
Iron	6·66
	100

Urea is a substance contained in the urine, and is procured from it by the following process: evaporate urine to the thickness of a syrup, then add nitric acid, which will form a nitrate of urea, insoluble in iced cold water; to this, after repeated washing, add carbonate of potash; nitrate of potash is formed, carbonic acid evolved, and urea set free; it is then to be taken up by water and treated with charcoal to decolorise it. The solution being evaporated, urea is left. To obtain it in pure crystals it may be repeatedly dissolved in alcohol.

It may also be artificially formed by heat, or the external air acting on cyanate of ammonia, and this indeed is the first organic substance that has been formed by chemists from inorganic elements. The composition of urea is the following:

$$C_2\,H_4\,N_2\,O_2.$$

Properties.—Urea is colourless, transparent, with a faint smell, cool to the taste, very soluble in water, less so in alcohol, does not change litmus or turmeric paper, by heat is decomposed and converted into carbonate of ammonia. Urea appears to be the substance by which the natural excretion of nitrogen from the system chiefly takes place.

Uric acid is found in small quantity in the urine, in a large proportion in gouty concretions, also in the solid excrement of the boa constrictor. The latter substance may be treated with potash, and forms urate of potash, which is then decomposed by some other acid, such as acetic, and the uric acid deposited. It is white, tasteless, and inodorous, requiring 10,000 times its weight of water at 60° for solution; mixed with nitric acid and heated, a purple colour is produced, owing to the formation of purpurate of ammonia, the murexide of some chemists. This acid unites with alkalies, and in that state is always found in the urine; when free it is deposited and forms a reddish sediment. Its composition is—

$$C_{10}\,H_4\,N_4\,O_6.$$

NON-AZOTIZED SUBSTANCES.

These are the various fats, the secretions of the sebacic glands, sugar, butter, and certain salts. Alkalies and acids also are found in the secretions and excretions; but many of these only in a morbid state of the system. The non-azotized articles of food appear to possess the power of forming materials for animal combustion, as in the respiration. Some chemists also assert that they can produce fat, &c., but this is difficult to be proved. Majendie has by a series of experiments shown that alone they are incapable of supporting life; but at the same time it has been found that a certain quantity is positively necessary, inasmuch as animals soon died which were fed on azotized substances alone.

The following account of the composition of the various parts and fluids of the body is in accordance with the best authorities; but chemists differ so much in respect to their results of the analysis of many of them, that we may consider the subject quite in its infancy, and likely to be remodelled oftentimes before a general conclusion can be arrived at.

Blood, when fresh drawn from an animal, appears to be a homogeneous fluid; but if allowed to rest, it first coagulates, and subsequently it separates into two distinct portions, the serum and crassamentum. This coagulation occurs in from four to seven minutes.

The blood in the vessels of the animal consists of a plasma, or liquor sanguinis, and corpuscles.

The crassamentum is composed of the corpuscles, mechanically inclosed in a network of the spontaneously coagulating fibrine, whilst the serum contains the remaining ingredients of the plasma.

The following composition of the blood is from the analysis of M. Lecanu:

Water	780·15
Fibrine	2·10
Albumen	65·09
Colouring matter	133·00
Crystallizable fat	2·43
Fluid fat	1·31
Salts, including iron	10·47
Extractives	1·79
Albumen, in combination with soda	1·26
Loss	2·40
	1000

The proportions differ in the sexes, at different ages, and in different states of the body; thus, in females more water exists than in males, and in fever the quantity of fibrine has increased, the quantity of the corpuscles having in an equal ratio diminished. The blood of the arteries contains oxygen gas in a greater proportion than that of the veins, whilst the latter has a larger quantity of carbonic acid than the former in its composition. The specific gravity of the blood is about 1·055.

Saliva consists chiefly of water and mucus, but contains also hydrochlorate, phosphate, sulphate, lactate, and carbonate of potash, sulpho-cyanide of potassium, phosphate of lime, and a trace of soda. The sulpho-cyanide causes it to give a red colour with a persalt of iron.

Salivary concretions are chiefly composed of carbonate and phosphate of lime.

Pancreatic juice somewhat resembles saliva, containing in addition albumen and osmazome. This fluid, however, is distinguished from saliva of the mouth, by not containing sulpho-cyanic acid.

Bile.—This is a fluid of a yellowish green colour, darkening by exposure to the air; it has a disagreeable odour, a nauseous bitter taste, is distinctly alkaline, and mixes with water in all proportions. The most recent analyses of bile represent it as consisting of colouring matter, cholesterine, choleic acid, and soda; the two latter forming the largest constituents, so that it may be called a *choleate of soda.* Choleic acid consists of $C_{44}\,H_{40}\,NSO_{9}$. By boiling bile with a concentrated solution of potash an acid called cholic is formed, closely resembling the choleic. It has an intensely bitter taste, and forms soluble salts with the alkalies. Its formula is $C_{74}\,H_{60}\,O_{18}$.

Gall-stones consist chiefly of adipocire, with a small quantity of colouring matter and cholesterine.

Chyle differs but little from the blood as regards its composition and properties; it contains a thin fluid and corpuscles; the latter, however, are not highly coloured: like the blood it coagulates, but much less firmly and more slowly. It owes its white colour to fat-globules suspended in the fluid. The same phenomenon is sometimes observed in the serum of the blood itself. It appears to be blood in an early stage of formation.

Lymph.—Under this name there have been confounded two fluids very different in properties; the former is the chyle. The lymph itself, however, appears to resemble closely the serum of the blood, containing sometimes a large proportion of fibrine and albumen, as in that which is effused from wounds, &c.; sometimes a smaller proportion, as in the liquor amnii and the serum of dropsy.

Milk is a fluid of a white colour, with a slight odour, and a sweetish agreeable taste. It consists of a transparent fluid and transparent corpuscles, the colour only being owing to the peculiar reflection of light. It affords a type of perfect food, containing an azotized material, caseine, and two non-azotized—one fatty, the butter, the other sugar; salts also are contained in it, of these the most important is phosphate of lime, which is held in solution by the caseine, and is required for the formation of the bones of the young animal. By the gradual collection of the fatty matters at the surface, the layer called cream is formed. Butter is produced by agitation of the cream, with the separation of the caseine, a small quantity of corpuscular matter always remaining in the fluid. Cheese is formed by coagulation of the caseine; this is effected by the animal matter rennet contained in the stomach of the calf, or other animals. The caseine is held in solution in the milk by the presence of a small quantity of soda. From a recent analysis of M. Haidlen, the composition of cows' milk in 1000 parts is the following:

Water	873·00
Butter	30·00
Caseine	48 20
Milk sugar	43·90
Phosphate of lime	2·31
„ magnesia	·42
„ iron	·07
Chloride of potassium	1·44
„ sodium	·24
Soda, in combination with caseine	·42
	1000

Human milk scarcely differs from this, saving that it contains more sugar, and less butter and caseine.

When milk is boiled the caseine rises to the surface, forming a crust, which may be skimmed off, and this is one of the diagnostic tests of caseine. Human milk is remarkable for its difficulty of coagulation.

Urine is a limpid yellowish fluid, with an acid reaction, averaging in specific gravity 1·020. It is speedily decomposed by exposure to heat or the air, ammonia being generated in great abundance. The urine may be looked upon as the great outlet of nitrogen from the system. It removes also excess of water, and soluble foreign matters that get into the blood. The quantity of urine voided on an average is 32 ounces daily. The following is the analysis of healthy urine, according to Berzelius, in 1000 parts:

Water	933·00
Urea	30·10
Lactates and extractives	17·14
Uric acid	1·00
Sulphates of potash and soda	6·87
Phosphate of soda	2·94
„ ammonia	1·65
„ lime and magnesia	1·00
Chloride of sodium	4·45
Sal ammoniac	1·50
Silica	·03
Mucus of bladder	·32
	1000

In certain diseases the urine contains other components, such as albumen, sugar, or hippuric acid. The yellow principle of bile is sometimes observed, and the uric acid also is sometimes in increased quantity.

Deposits from the urine called calculi are frequently formed; these are divided into five principal groups. Calculi are sometimes formed by layers of one variety superimposed on another, and are then named alternating calculi.

The five species are the following:

1. The *uric acid calculus* is most common of all; externally the colour is brownish red, or fawn coloured, it is decomposed by the blowpipe, leaving a white ash often alkaline of another substance, which had formed the nucleus. It is insoluble in water, soluble in caustic potash; but is again precipitated by almost any acid. Heated with nitric acid, a little ammonia being added, it gives the deep purple colour of murexide.

2. The *urate of ammonia* calculus is one of the most irritating to the system. It is generally smooth on its surface, composed of concentric layers, and seldom attains a large size; before the blowpipe it crepitates; acted on by hydrochloric acid, uric acid is deposited. It is decomposed by caustic alkali, with the evolution of ammonia.

3. *Mulberry*, or oxalate of lime calculus, has a dark reddish-brown tuberculated surface; it is convertible before the blowpipe into a white powder (lime), and is soluble in nitric or hydrochloric acids; it is very frequent in some districts.

4. The *phosphate of lime* calculus is of a pale brown or gray colour, smooth, in regular laminæ, oval, sometimes very large; infusible before the blowpipe; is soluble in hydrochloric acid.

5. The *ammonia-magnesian* calculus has generally a white or grayish uneven surface; it is rather compact and imperfectly laminated; heated before the blowpipe it gives out ammonia, and leaves phosphate of magnesia as a residue.

This calculus often mixes with the preceding one, and they form together the *fusible* calculus of Wollaston; this is white on its surface, friable, and has a great resemblance to chalk; soluble in hydrochloric acid, after which, if oxalate of ammonia be added, a copious oxalate of lime is precipitated.

Two other calculi occur, but are very rare: these are the *cystic oxyde*, and the *xanthic oxide*. Calculi of cystic oxide are generally of a yellowish white surface, internally crystalline, easily dissolved by both acids and alkalies. It occurs of a small size, sometimes presenting a waxy appearance.

Xanthic oxide is distinguished by the deep yellow colour it gives with nitric acid when evaporated. It is soluble in alkalies, but not in hydrochloric acid.

Sweat appears to consist of water and salts, with certain gases; nitrogen is evolved with this secretion, but in a smaller quantity than in the urine. The secretion of the sebacic glands has not yet been fully examined.

Mucus.—This varies greatly with the part from which it is effused; it is insoluble in water; soluble in alkalies, but precipitated by acids. The mucus of the nose contains water, mucous matter, salts of potash, soda, and lime, albumen and animal matter.

Pus is ordinarily a viscid liquid of a creamy colour and consistence, inclining to a yellowish-green, opaque and homogeneous; it is inodorous, possessing feeble taste, neither acid or alkaline, though it becomes acid on exposure to the air, with disengagement of ammonia. Examined by the microscope it appears composed of a fluid and corpuscles; it is not soluble in water, subsiding after a time. When mucus and pus exist together in a fluid, the pus falls, the mucus remains in a state of suspension.

Pus is coagulated by heat and dilute acids. It is soluble in strong nitric or sulphuric acids. Brunefield asserts that pus is coagulated by boiling with a solution of hydrochlorate of ammonia, but that mucus forms with it a mucilaginous liquid.

Caustic alkali does not dissolve pus, but converts it into an adhesive mass that can be drawn out like thread. This is one of the modes of distinguishing it from mucus.

Chalk-stones, or gouty concretions, are composed principally of uric acid in combination with soda.

Synovia is a compound of water, fibrinous matter, albumen, salts of soda, and lime.

Tears contain water, albumen, mucus, and several neutral salts.

Gastric juice has been obtained during late years by Dr. Beaumont in a much more separate and pure state than previously, so that its composition may be stated with greater confidence than before. On analysis it yielded to him and to others—

Free hydrochloric acid; acetic acid; phosphate of potash, soda, magnesia and lime; hydrochlorates of the same bases; pepsin; animal matters, extractives.

The following is the composition of the principal tissues of the body.

Bone.—The chief constituents of this substance are animal matter and salts of lime. The animal matter exists in the proportion of 33 parts per cent., quite sufficient to keep the original shape of the bone when the earthy matter is removed by acid. The bones of the adult, however, are much richer in earthy matter than those of the child, and some of the bones contain more animal matter than others in the same person.

The following is the analysis of Berzelius:

Gelatine soluble in water	32·17
Vessels	1·10
Subphosphate of lime with a little fluoride of calcium	53·04
Carbonate of lime	11·30
Phosphate of magnesia	1·16
Soda, with a trace of chloride of sodium	1·20
	100

The *teeth* are very similar in composition, but do not contain so much animal matter. The enamel of the teeth is almost exclusively formed by the salts of lime, the animal matter not forming 5 per cent.

Muscle consists chiefly of fibrine, with gelatine, osmazome, albumen, neutral salts of soda, lime and ammonia, and some nervous matter and blood.

The *brain* and *nervous* matter consists of water, white fatty matter, albumen, osmazome, phosphorus, salts, acids, and sulphur. Two new fatty acids have recently been discovered in the brain, the cerebric and the oleophosphoric, but their composition is as yet very imperfectly known.

Tendons are composed principally of gelatine.

Ligaments and *membranes* are composed chiefly of coagulated albumen, and gelatine.

The *nails* are composed of coagulated albumen, gelatine, salts, earthy matter, and a little water.

The *humours* of the eye consist of water, albumen, animal matter resembling gelatine, and several neutral salts.

TOXICOLOGY.

TOXICOLOGY treats of the nature, antidotes, action, and tests of poisons.

Poisons are often described as of five kinds: corrosive, acrid, narcotic, narcotico-acrid, and septic; but, for all practical purposes, may better be restricted to three; irritant, narcotic, and narcotico-acrid. Irritant poisons include those which are corrosive, as strong acids and alkalies, as well as the powerful mineral substances, such as the preparations of arsenic, mercury, silver, antimony, copper, barytes, tin, zinc, the earths, phosphorus, &c.

The general symptoms produced by corrosive or irritant poisons, are heat, irritation, and dryness about the mouth, fauces, and œsophagus, with a sensation of constriction; vomiting, sometimes of blood; great pain in the stomach and bowels; thirst; copious evacuations by stool, with tenesmus, a sensation of constriction about the diaphragm, and difficulty of breathing; pain in the kidneys and strangury; convulsions; cramps in the hands; trembling of the lips; syncope; small, corded, and irregular pulse, and cold clammy perspirations; there is also sometimes a miliary eruption, or purple spots about the body.

The symptoms just described will not all be perceived in a single case, but are intended to represent such as may take place from these poisons collectively.

Corrosive sublimate is said to be known by the profuse salivation, the mercurial fœtor, swelling of the salivary glands, and diminished secretion of urine, and often mixed with blood; however, these supposed diagnostic signs cannot be much depended on. The symptoms of poisoning come on sooner than from arsenic, on account of its greater solubility.

Copper has been distinguished by the coppery taste in the mouth, the severe gripings, and occurrence of jaundice.

Arsenic has been fully described in the Materia Medica.

Mineral acids are known by the destruction of the soft parts of the mouth; the matter vomited is black, particularly from sulphuric acid, and causes effervescence if dropped upon the hearthstone. The intellect is generally but little impaired. Nitric acid is known by giving out fumes of nitrous acid gas, and the yellow stains on the lips. Sulphuric acid blackens the lips and parts of the body with which it may have come in contact. Hydrochloric acid turns the mucous surfaces white.

Oxalic acid, although classed as an irritant, acts more as a sedative poison. The symptoms produced by it are those of intense collapse, and it kills rapidly by its action upon the blood, and by destroying the action of the heart.

Potash, soda, and ammonia are distinguished by the urinous acrid taste; the vomited matter feels soapy, and sometimes effervescences with acids.

Ammonia is known by the pungent odour which it evolves.

Morbid appearances produced by irritant poisons.—The alterations in the different parts will vary considerably, according to the greater or less chemical influence of the poison. Corrosive poisons, in addition to the common appearances produced by irritants, corrode and destroy by their chemical action the mucous membrane of the mouth, fauces, œsophagus, and stomach; whilst irritants not corrosive produce increased vascularity and redness of the lining mucous membrane of the stomach and intestines, occasionally ulceration and perforation, a copious secretion of thick mucus, coagulable lymph, or extravasation of blood, and, in some cases, excoriation about the anus.

Treatment for corrosive irritant poisons.—The general treatment consists in evacuating the stomach as quickly as possible; but, as the action of the mineral acids, and some others, is very rapid, it is first necessary to administer antidotes to render the poison inert, and give tepid mucilaginous drinks, to make the vomiting as easy as possible. Castor-oil may afterwards be administered, and the inflammatory consequences treated on general principles. The stomach-pump must not be employed when there is any suspicion of the soft parts being softened or corroded. Amongst the antidotes most efficacious may be enumerated the following:

White of eggs is considered one of the best for arsenic, and the hydrated peroxide of iron has been reported to be an effectual antidote for this poisonous acid.

White of eggs, for corrosive sublimate and preparations of copper.

Decoctions of yellow cinchona, galls, or tea, for tartar emetic.

Sulphate of magnesia, or soda, for the soluble salts of baryta and lead.

Chloride of sodium, *alias* table salt, for nitrate of silver.

Magnesia, chalk, or soap-suds, for acids.

Oxalic acid requires the administration of chalk or magnesia, which are best given in a quantity of milk.

Some fixed oil should be given for alkalies, as it modifies the effect of the poison, by combining with it and forming a soap; vegetable acids, as vinegar or lemon-juice are also recommended, but are not so useful as the oils, chiefly on account of the difficulty of swallowing them.

VEGETABLE IRRITANT POISONS.

Amongst them are the helleborus niger and fœtidus, elaterium, colocynth, euphorbium, ricinus, ranunculi, delphinium, mezereum, juniperus sabina.

The symptoms are very similar to those produced by corrosive poisons, but milder. There is generally vomiting and purging, pain in the stomach and intestines, quick breathing and vertigo, syncope, labouring pulse, cold sweats, convulsions, and sometimes paralysis.

Treatment.—Assist the vomiting, if commenced, by mucilaginous drinks; if not excited, give from five to ten grains of sulphate of copper, or a scruple or two of sulphate of zinc. After the poison is evacuated, give coffee, acids, and camphor, according to circumstances, and combat the inflammation in the usual manner.

NARCOTIC POISONS.

The principal narcotic poisons are opium, lactuca hyoscyamus niger, solanum dulcamara, laurel water, stramonium, &c.

Symptoms.—The symptoms of narcotic poisons, and of opium in particular, are, stupor, drowsiness, insensibility and immobility, respiration scarcely perceptible, pulse small and feeble, but sometimes full and slow; as the effects increase, the lethargic state becomes more profound; swallowing is suspended; the breathing sometimes is stertorous; the pupil is contracted by opium, but dilated by other narcotics; the countenance pale and cadaverous; the muscles of the limbs and trunk are relaxed; sometimes there is vomiting, but the coma soon returns, and death, which is occasionally preceded by convulsions, soon follows.

Treatment.—Administer a powerful emetic, such as half a drachm or two scruples of sulphate of zinc, assisted by copious mucilaginous drinks, and at the same time dash cold water over the head and chest. If the stomach-pump be at hand, inject plenty of gruel or tepid water into the stomach, and endeavour to draw off the poison. After the poison has been satisfactorily evacuated, give coffee, strong tea, ammonia, or cordials. The patient should be sedulously kept awake till the symptoms have subsided. Strong coffee or tea is better for opium, and brandy and ammonia are the best remedies for digitalis.

Hydrocyanic acid and its allies, such as essential oil of bitter almonds, may be considered to be sedative poisons, destroying life sometimes in a minute or little more. The most striking symptoms are insensibility, glassy eye, dilated pupil, ghastly livid countenance, feeble pulse, a flow of saliva and froth at the mouth, and a cold clammy skin, with gasping breath, and sometimes convulsions. The best treatment consists in applying ammonia to the nostrils, giving a weak solution of chlorine, dashing cold water on the face and chest, and endeavouring to excite artificial respiration, which should be persevered in for some time.

CANTHARIDES.

The principal symptoms produced by cantharides are, the burning heat in the œsophagus and stomach, vomiting of blood, priapism, suppression of urine, attended with discharge of blood from the urethra. The appearances after death are those of inflammation of the lining mucous membranes.

The treatment consists principally in administering demulcents and antiphlogistics. No real antidote is yet known. The administration of oil is objectionable, as it increases the solubility of the cantharidine.

POISONOUS FISH.

Symptoms occasioned by them: sensation of weight at the stomach, nausea, vertigo, heat about the head and eyes, and occasionally tumefaction of those parts; colicky pains; thirst, and often urticaria.

The necessary treatment consists in administering an emetic, with copious draughts of warm water; then a purgative and anodynes. If excessive vomiting or spasms supervene, ether and ammonia should be given.

POISONOUS SERPENTS AND INSECTS.

The viper, rattlesnake, scorpion, &c.

Symptoms.—A sharp pain in the wounded part, which soon extends over the limbs or body; great swelling, at first hard and pale, then reddish, livid and gangrenous in appearance; faintings, vomitings, convulsions, and sometimes jaundice; pulse small, frequent, and irregular; breathing difficult; cold perspiration; the sight fails, and the intellectual faculties become deranged; inflammation and gangrene often supervene, and death soon follows.

Treatment.—Apply a ligature moderately tightened above the bitten part; allow the wound to bleed: after bathing and fomenting it well with warm water, apply freely to the wound the actual cautery, lunar caustic, or the butter of antimony; afterwards cover it with lint dipped in olive oil and hartshorn. Give warm diluent drinks, with ammonia, occasionally a little wine, and let the patient be well covered in bed to induce perspiration. Should gangrene threaten, wine and bark may be given more liberally.

A dry cupping glass applied over the part has been found eminently successful in these cases, immediately after the infliction of the wound. It acts by preventing the absorption of the poison.

NARCOTICO-ACRID POISONS.

In this class are included those vegetable poisons which act locally, producing irritation and inflammation, and remotely giving rise to the effects of narcotism. In sufficient doses they usually prove fatal within twelve hours.

The symptoms occasioned by them closely resemble those produced by narcotics and irritants, and require no separate consideration.

These poisons are principally derived from the natural orders, solaneæ, umbellatæ, ranunculaceæ, and fungi. The most powerful are the atropa belladonna, solanum dulcamara, nicotiana tabacum, conium maculatum, cicuta virosa, œthusa cynapium, œnanthe crocata, aconitum napellus, helleborus niger, scilla maritima, digitalis purpurea, veratrum album, colchicum autumnale, nux vomica, camphor, and cocculus indicus.

Nux vomica is especially distinguished by the violent tetanic symptoms it produces.

The treatment to be adopted is the same as is generally necessary in poisoning by the narcotics.

TOXICOLOGICAL CHEMISTRY;

OR, TESTS FOR THE PRINCIPAL POISONS.

ARSENIC.

The following are the tests for arsenic:

Ammoniacal sulphate of copper, added to a solution of arsenic, proluces a green precipitate of arsenite of copper, called Scheele's green, ulphate of ammonia remaining in solution.

Ammoniacal nitrate of silver, added to a solution of arsenic, proluces a lemon yellow precipitate of the arsenite of silver, leaving itrate of ammonia in solution.

Sulphuretted hydrogen, transmitted through a solution of arsenic, roduces a lemon yellow precipitate of tersulphuret of arsenicum, or rpiment soluble in an excess of the gas. This precipitate may then e heated with black flux, and the metallic arsenic will be sublimed. This is one of the most certain tests for arsenic.

If arsenious acid be mixed with potash and charcoal, and heated in glass tube, metallic arsenic sublimes and forms a brilliant metallic oating on the sides of the tube.

When metallic arsenic is thrown on burning coal, it vaporises with a hite smoke, and a smell resembling garlic.

When arsenic is tested for in the stomach, or mixed fluids, the subtances submitted to analysis should be boiled with distilled water: cetic acid is employed to precipitate animal matter, and charcoal to emove any colour. If the fluid be alkaline, or should alkali be added, t should not be in excess, as it prevents the falling down of the roper precipitate when tests are employed. The precipitates formed y the three tests first mentioned are all soluble in alkaline liquids, onsequently the liquid to be tested must be neutral or slightly cidulated.

The *hydrogen test* is performed as follows:

The suspected liquid is put into a bottle, and to this metallic zinc nd dilute sulphuric acid are added; water is decomposed by the zinc, nd hydrogen is set free. This nascent hydrogen decomposes arsenious cid, forming water and gaseous arseniuretted hydrogen. This gas, assing off by a fine tube, is to be ignited at its exit, and by burning, orms arsenious acid and water; a cold substance brought close to the urning gas, will have the white arsenious acid deposited upon it, and if, by closer approximation of the cold body to the burning gas, the combustion be somewhat impeded, metallic arsenic may be seen in the centre of the arsenious acid.

The sources of fallacy may be, impure zinc containing arsenic, impure sulphuric acid, and the presence of antimony, which will give almost the same appearance as arsenic.

Reinsch's test consists of introducing a clean plate of copper, and adding a little hydrochloric acid to the suspected liquid; in a short time, if heat be applied, the copper will be covered by metallic arsenic, which can afterwards be obtained separate by sublimation.

CORROSIVE SUBLIMATE.

The following are the best tests for corrosive sublimate in solution:

Protochloride of tin throws down a grayish-black precipitate of metallic mercury, bichloride of tin being in solution. This is one of the most valuable tests for corrosive sublimate. If the precipitant be in a small quantity, a white precipitate, viz., calomel, will fall down. When the mercury falls, it is considered that two equivalents of protochloride of tin are engaged in decomposing one equivalent of bichloride of mercury.

Albumen produces a white precipitate of calomel and albumen, or a triple insoluble compound.

Galvanism.—Place a small quantity of the solution on a piece of gold, and bring into contact with it a key, or some piece of iron, so as to form a galvanic circle. If corrosive sublimate be present, the gold will be whitened, by the mercury uniting with the gold, and the chlorine passing to the iron.

Iodide of potassium throws down a precipitate of a bright scarlet colour, which is the biniodide of mercury, two equivalents of chloride of potassium remaining in solution. The precipitate is soluble in excess of the iodide of potassium, consequently it should be added very cautiously.

Hydrosulphates throw down a black precipitate, the sulphuret of mercury.

Solution of potash, added to corrosive sublimate, produces a red precipitate, the peroxide of mercury; but added in excess, it throws the yellow hydrated peroxide.

Lime-water, added to corrosive sublimate, produces a red, and in excess a yellow precipitate of hydrated peroxide of mercury.

Ammonia added to corrosive sublimate produces a white precipitate, hydrargyri ammonio-chloridum of our Pharmacopœia.

If heated in a glass tube with carbonate of potash, globules of mercury may be obtained.

If it be necessary to procure corrosive sublimate from the tissues, they should be boiled with distilled water, and then ether may be added, which appears to dissolve this substance almost electively. The saline matter may be separated from the ether by heat, and dissolved in separate portions of water to apply the several tests.

PREPARATIONS OF COPPER.

The tests for the salts of copper are the following:

Ammonia produces a deep blue solution: at first the solution becomes turbid, and of a pale bluish green colour, and afterwards intensely blue and transparent, by adding more ammonia.

Ferro-cyanide of potassium produces a gelatinous reddish-brown precipitate, the ferro-cyanuret of copper.

Hydrosulphuric acid gives a black precipitate of sulphuret of copper. This precipitate, treated with nitric acid, decomposes the acid; takes oxygen to combine with the sulphur and form sulphuric acid, and with the copper to form an oxide, producing a sulphate of copper. If to this ammonia be added, a beautiful blue colour will result. This is an excellent test of copper. The sulphuret will also yield the metal by heat.

A clean plate of iron, immersed in a solution of sulphate of copper, will in a short time have a coating of metallic copper.

Heated in a crucible with charcoal, metallic copper may be obtained.

TARTAR EMETIC, OR POTASSIO-TARTRATE OF ANTIMONY.

The tests for tartar emetic are the following:

Hydrosulphuric acid, or *hydrosulphate of potash*, will throw down an orange-red precipitate, the hydrated oxy-sulphuret.

Gallic acid, or *infusions of galls*, causes a whitish-yellow precipitate, the tannate of antimony.

Sulphuric acid produces a white precipitate, soluble in an excess of the acid.

THE ACIDS.

The acids may be distinguished from other substances by the following tests: they convert most vegetable blues into red; they have a sour taste; the addition of an alkali destroys these properties.

The following are the acids most commonly used for poisoning: sulphuric, hydrochloric, nitric, oxalic, and hydrocyanic.

The tests for sulphuric acid are:

Chloride of barium, and other soluble salts of baryta, produce a white precipitate of sulphate of baryta, insoluble in acids and alkalies.

Nitrate of lead, which produces a white precipitate, the sulphate of lead, insoluble in nitric acid.

Tests for hydrochloric acid:

Nitrate of silver produces a copious white precipitate, the chloride of silver, soluble in ammonia, but insoluble in nitric acid.

Bring the fumes of the concentrated acid in contact with ammoniacal gas, and white fumes will be formed.

A little nitric acid being added to it, chlorine is set free, and it becomes a solvent of gold.

Tests of nitric acid:

Heated with many metals, nitrous acid fumes are evolved.

Mixed with a little hydrochloric acid it forms a solvent for gold leaf.

A crystal of morphia put into it, first turns red, afterwards yellow.

Add to it a little carbonate of potash, and nitrate of potash will be formed, readily known by its prismatic crystals and deflagrating qualities.

The tests for oxalic acid are:

Chloride of calcium, which causes a white precipitate of oxalate of lime, soluble in nitric acid, but insoluble in small quantities of hydrochloric acid.

Sulphate of copper throws down a bluish white precipitate of the oxalate of copper, which is insoluble in a few drops of hydrochloric acid.

Nitrate of silver throws down a white precipitate of the oxalate of silver, which when dried and heated, fulminates.

By heat it is volatilized.

It crystallizes in six sided prisms with dihedral summits.

Tests for hydrocyanic acid:

Its odour like that of bitter almonds.

If potash be added, and then a solution of sulphate of iron, a greenish precipitate is produced. If to this, dilute sulphuric acid is added, a compound of a blue colour is formed, named Prussian blue.

Nitrate of silver forms a cyanide of silver, insoluble in cold nitric acid, and which, when dried and heated, gives out cyanogen gas.

LEAD.

The tests for lead are the following:

Hydrosulphuric acid produces a black precipitate, the sulphuret of lead, which, by heat and charcoal, is easily reduced to a metallic state.

Chromate of potash, and *the iodide of potassium*, produce a gamboge yellow precipitate, the chromate and iodide of lead.

Infusion of galls produces a white precipitate of gallate of lead.

Sulphuric acid, or any soluble sulphate, produces a white precipitate, the sulphate of lead, insoluble in nitric acid.

A piece of zinc put into the solution of salts of lead causes metallic lead to be deposited in an arborescent manner.

SULPHATE OF ZINC.

The tests for the sulphate of zinc are:

Ferrocyanide of potassium, which produces a white precipitate.

Hydrosulphuric acid and *the hydrosulphates* produce a white precipitate, the hydrated sulphuret of zinc.

Alkalies produce a white precipitate, the hydrated oxide, which is soluble in excess of alkali.

Infusion of galls produces no precipitate.

NITRATE OF SILVER.

The tests for nitrate of silver are the following:

Hydrochloric and the soluble hydrochlorates produce a white precipitate, chloride of silver, which becomes purplish-brown by exposure to light.

Arsenite of potash produces a yellow precipitate of arsenite of silver.

The solution stains the skin black.

Hydrocyanic acid causes a flocculent white precipitate of the cyanide of silver, soluble in ammonia, insoluble in cold nitric acid, but soluble in it when heated. By heat it is decomposed, and resolved into cyanogen and silver.

The pure alkalies throw down oxide of silver of a brown black colour.

Hydrosulphuric acid and hydrosulphates precipitate a black sulphuret of silver.

Mercury and most metals added to the solution cause metallic silver to be deposited.

Oxalic acid throws down a white oxalate of silver, which fulminates violently when heated.

IODINE.

The tests for iodine are the following:

It stains the skin brown.

It destroys vegetable colours like chlorine.

Heated in a tube it is converted into a violet-coloured gas.

A solution of starch added to it produces a dense blue compound.

THE ALKALIES.

The solutions of alkalies feel soapy to the touch; they change most vegetable reds and blues to green, and yellows to brown, and remain transparent when carbonic acid is added to them, which distinguishes them from the alkaline earths.

Potash may be distinguished from soda by the following tests:

Tartaric acid produces a precipitate of bitartrate of potash.

Bichloride of platinum throws down a yellow precipitate.

Perchloric acid forms a compound with potash of very sparing solubility.

Soda does not form a precipitate with any acid.

Its salts, exposed to the flame of a blowpipe, upon a platinum wire, produce a rich yellow colour.

THE ALKALINE EARTHS.

Lime may be detected by—

Oxalate of ammonia, which causes a white precipitate, insoluble in an excess of oxalic acid.

Carbonic acid, which causes a white precipitate, soluble in excess of carbonic acid.

Baryta may be known by—

Sulphuric acid, and all the soluble sulphates, producing a white precipitate, insoluble in nitric acid.

NITRATE OF POTASH.

The nitrate of potash may be distinguished by its crackling, and producing a white flame when thrown on burning coals. Heated with sulphuric acid it produces nitrous fumes, and with the chloride of platinum it throws down a yellow precipitate.

HYDROCHLORATE OF AMMONIA.

The tests for hydrochlorate of ammonia are:

Quicklime rubbed with it causes an ammoniacal odour.

Nitrate of silver added to a solution of this salt causes a white precipitate.

PREPARATIONS OF IRON.

I have appended to this section, for the sake of convenience, the tests of iron, although this metal cannot be considered as a poison.

The tests for protosalts of iron are—

Gallic acid throws down no precipitate.

Ferrocyanide of potassium throws down a pale greenish-white precipitate, which afterwards becomes blue by exposure to the air.

Ferrid-cyanide of potassium produces a blue colour.

Alkaline carbonates throw down a white precipitate.

Alkalies throw down the white hydrated protoxide.

Hydrosulphuric acid throws down nothing, but hydrosulphate of ammonia throws down a black precipitate.

The tests for the peroxides and persalts of iron are—

Ferrocyanide of potassium throws down Prussian blue.

Sulphocyanide of potassium produces a blood-red colour, removable by a solution of bichloride of mercury.

Meconic acid also produces a blood-red colour, which is not destroyed by the bichloride of mercury.

Gallic acid, or tincture of galls, produces a blue black colour like ink.

Alkalies and their carbonates throw down a reddish-brown, or foxy coloured precipitate, insoluble in excess of the reagent.

Hydrosulphuric acid gives a white precipitate, consisting of sulphur and protoxide of iron.

Hydrosulphate of ammonia causes a black precipitate.

ANATOMY.

THE VISCERA.

The viscera of the body comprise the organs contained in the cavities of the cranium, thorax, abdomen, and pelvis. We shall first consider the contents of the cranium, which are the brain and its membranes, together with the cerebral nerves, after which we shall speak of the nervous system in detail.

The cavity of the cranium is formed by eight bones, four of which are single, viz., the *frontal*, *ethmoid*, *sphenoid*, and *occipital*, the remaining are double, viz., two *parietal* and two *temporal*.

These bones are united by a peculiar mode of junction called suture, consequent upon the peculiar development of these bones. The sutures are named the *lambdoidal*, *sagittal*, *coronal*, and *squamous*, to which are added the *additamentum suturæ squamosæ*, and the *additamentum suturæ lambdoidali*. In the young subject also, the frontal bone is divided vertically into two halves by a continuation of the sagittal suture.

These bones are not united before birth, their borders allowing a considerable amount of overlapping, thus permitting a great alteration of the shape and size of the fœtal head during parturition. At the central junction of the frontal and parietal bones there exists, at this time, a diamond-shaped interval, called the *anterior fontanel*, and posteriorly to this exists a triangular-shaped interval, in the situation of the subsequent junction of the lambdoidal and sagittal sutures, and called the *posterior fontanel*.

The structure of the bones of the head is somewhat peculiar; they are formed by an external and internal plate, the latter of which, from its hardness and shining appearance, is named the *tabula vitrea;* they are separated by a layer of very spongy and vascular bone, called the *diploe.* This diploe does not exist in the very young subject, and it partly disappears in old age. The bones of the cranium are considered to have no real periosteum, as they are covered externally by the pericranium, which is thinner than periosteum generally, whilst their internal investment is formed by the dura mater.

The membranes covering the brain are the dura mater, arachnoid, and pia mater.

The *dura mater* is a dense strong fibrous membrane of a white pearly appearance, rough externally where it is adherent to the bones of the cranium, smooth internally where it is lined by the arachnoid, hence called by some fibro-serous. It also extends down the spinal canal in the form of a sheath to the spinal cord, but it does not form the periosteum to the bones, as in the cranium, being separated from them by veins, serous fluid, fat, and cellular tissue. The fibres of the dura mater run in various directions, the external being longitudinal, the internal circular, and the intervening ones taking various courses. The rough external surface of the dura mater is occasioned by the numerous minute vessels running from it to the bone; the smoothness of the internal coat is considered to be caused by its being invested by the arachnoid. On the dura mater, near the vertex, are seen several small hard white glandular-looking bodies, called Pacchionian glands; their use is unknown. ·

The dura mater also enters the orbit, and may be said to form its periosteum, and it forms a covering to the optic nerve, and thus becomes continuous with the sclerotic coat of the eye.

The arteries supplying the dura mater are, anteriorly from the ophthalmic, in the middle from the arteria meningea media, and parva from the internal maxillary; and posteriorly some small branches from the ascending pharyngeal, vertebral, and occipital arteries.

The veins of the dura mater empty themselves into the neighbouring sinuses. The dura mater serves as a channel for the passage of the nerves from the cranium, and surrounding most of them at their exit.

The dura mater is divisible into two layers, the external one of which is the thickest and always remains closely attached to the bone, the internal one forming several folds in the cranium in the margins of which run the sinuses. The principal of these folds are the falx major, the falx minor, and the tentorium.

The *falx major* (so called from its resemblance in shape to a sickle) is of a semilunar shape, its greater edge being superior and attached to the bones of the cranium, its lesser inferior and free; the anterior end invests the crista galli, the posterior or larger end terminates on the tentorium. As it separates the two hemispheres of the brain from one another, it prevents sudden compression of either from a rapid motion of the head.

The *tentorium* runs in exactly the reverse direction of the falx major, for instead of being vertical it is horizontal, and instead of running from before backwards it runs from one side to the other. It separates the posterior cerebral lobes from the cerebellum, and protects the cerebellum from the pressure of the cerebrum. In some animals it is osseous.

The *falx minor* runs from the foramen magnum to the tentorium, finally spreading out into the latter. Its size is very small, as compared with the others.

Besides these, the dura mater forms a series of bridges, as they may be called, over all of those sinuses that do not run in the folds just mentioned; the most remarkable of these is that over the cavernous sinus.

The sinuses of the brain are sixteen in number, four of which empty themselves directly into the torcular Herophili, viz., the superior longitudinal, the straight, and the two occipital sinuses. Two lead from it, viz., the two lateral sinuses, whilst the nine remaining lie at the base of the brain, viz., the anterior and posterior clinoid sinuses, the two cavernous sinuses (which four together form the circular sinus of Ridley), the two superior petrosal, the two inferior petrosal, and the transverse. To these are sometimes added the torcular Herophili and the circular sinus, in which case there would be eighteen in all.

The *superior longitudinal* sinus commences at the foramen cæcum, which is situated just in front of the crista galli of the ethmoid bone; it passes first upwards, then directly backwards and downwards to empty itself into the torcular Herophili, where it generally pours the greater part of its blood into the right lateral sinus. This sinus runs in the superior or greater border of the falx major, of which the two layers form the sides of the sinus, the external layer of dura mater covering it in. It will be therefore seen to be triangular in shape. In its interior will be seen several fibrous bands stretching across, called *chordæ Willisii;* there are also a few Pacchionian glands. Several veins open into the great longitudinal sinus, the direction of which is from behind forwards, thus opposing the course of the blood in the sinus which is from before backwards; this arrangement checks the risk of regurgitation on any exertion, by which otherwise the blood would be sent back on the brain in every act of coughing, sneezing, or any other accidental excitement of the circulation.

The *inferior longitudinal* sinus runs in the same direction as the former, but along the lower border of the falx major, and being entirely surrounded by this it is almost circular in shape. It may be considered as commencing at the posterior end of the crista galli, and ending at the anterior edge of the tentorium, at which spot it terminates in the straight sinus which carries its blood to the torcular Herophili.

The *straight sinus* commences at the anterior border of the tentorium, where it receives the blood of the inferior longitudinal sinus and the vena Galeni; from this spot it runs backwards and somewhat downwards to terminate in the torcular Herophili.

The *occipital sinuses* (of which sometimes, however, there is only one) run in the posterior edge of the falx minor; they empty themselves into the torcular Herophili; they are very small, and sometimes communicate with the lateral sinuses at the anterior margin of the occipital foramen, which in such cases is almost entirely surrounded by them.

The *lateral sinuses,* of which the right is generally the largest, run from the torcular Herophili in a groove of the bone, to the posterior lacerated foramen of the base of the skull, terminating in the internal jugular veins. They run in the margin of the tentorium, and are consequently rather triangular in shape; they receive the blood from the torcular

Herophili posteriorly; in nearly the middle of their course they receive the blood from the superior petrosal sinuses, soon after which they receive the blood from the internal ear by small veins, and, just before their termination, they receive the inferior petrosal sinus as well as the inferior cerebral and cerebellar veins. In their course they groove the occipital, the parietal, and the temporal bones.

The sinuses which are more particularly situated at the base of the brain are the following:

The *cavernous sinuses* are situated one at each side of the sella turcica of the sphenoid bone. They are formed by a splitting of the dura mater into two layers, one of which is in contact with the bone, whilst the other arches over the contents of the sinus. Anteriorly it receives the ophthalmic vein, posteriorly it is continuous with the superior and inferior petrosal sinuses, whilst on its internal surface it receives the anterior and posterior clinoid sinuses. The cavity of this sinus is intersected by a number of fibrous bands, which give it a cellular appearance, and it also contains the following structures, viz., the third, fourth, and ophthalmic division of the fifth nerves, which lie partially against and are partially inclosed within its external layer, in the order indicated, from above downwards; and the internal carotid artery with the sixth cerebral nerve resting against the inner wall. The carotid or cavernous plexus of the sympathetic also surrounds the internal carotid artery in this situation.

The *clinoid sinuses* are situated one before and the other behind the pituitary body, from which they receive the venous blood by minute veins. The clinoid sinuses are very small, and form, by communications with the cavernous sinuses, the *circular sinus* of Ridley.

The *superior petrosal sinus*, on each side, extends from the posterior part of the cavernous sinus to about the middle of the lateral sinus, in which it terminates. Its course is backwards and outwards, and it runs lodged in a groove on the ridge which separates the superior from the posterior surface of the petrosal portion of the temporal bone. In size it is much smaller than the following.

The *inferior petrosal sinus*, much shorter than the preceding, runs in a groove formed by the adjacent borders of the sphenoid temporal and occipital bones. Its course is from the posterior and internal part of the cavernous sinus backwards, downwards, and slightly outwards, to the lateral sinus in which it ends, at the jugular fossa.

The *transverse sinus* runs from one inferior petrosal sinus to the other, across the basilar process. Sometimes there are two transverse sinuses, one of which runs somewhat below the other.

The *arachnoid* membrane, so called from its resemblance in delicacy to a spider's web, is a serous membrane (and, like all other serous membranes, a shut sac), of an extremely light, thin, transparent nature. Its external layer (in the cranium) invests the dura mater so closely that it can with the greatest difficulty only be separated from it, whilst its internal layer is but lightly attached to the tops of the convolutions of the brain, and does not dip down between them at all. The arachnoid invests most of the cranial nerves, as far as their exit from the cranium, but returns almost immediately; it also is considered by most anatomists to pass into the ventricles, lining them entirely; this is, however, denied by others. The place where it enters them is almost immediately under the posterior cerebral lobes, and is called the *fissure* of *Bichat*. The arachnoid also extends from the brain into the spinal canal, but it is much more dense, and much less adherent in this latter situation. The arachnoid may be most readily seen as it passes from one convolution of the brain to another. Between the arachnoid membrane and pia mater is found a variable quantity of a serous fluid called the sub-arachnoidean fluid, which sometimes exists in considerable quantity in the spinal canal.

Immediately under, and closely connected with the arachnoid membrane, is the third investment of the brain—the *pia mater*—a highly vascular structure, appearing to consist only of minute vessels and cellular tissue. It invests the brain most closely, covering its entire surface and dipping down between all the convolutions. It also passes into the lateral, and thence over the third ventricle, in which situation it forms the *tela choroidea*, or *velum interpositum*, found immediately underneath the fornix; it also sends a small process into the fourth ventricle. It passes down upon the spinal cord, but becomes much thickened, and at the same time less vascular, insomuch that Cloquet and some others have considered it, in this situation, to be a different structure; but this is probably without sufficient reason, as the pia mater of the spinal cord is quite continuous with that of the cranium, and only alters on account of the difference in the structure to which it is applied. Unlike the arachnoid, it is extended upon the nerves which quit the cranium and spinal canal, and becomes eventually identified with their neurilemma.

Besides these structures investing the brain and spinal cord, there is another in relation only with the latter, called the *ligamentum denticulatum*. This extends on each side for the whole length of the spinal cord. At its superior extremity it is inserted into the dura mater near the foramen magnum, and extends as far as the lower end of the cord. Its internal margin is attached to the whole length of the pia mater investing the spinal cord, whilst its external margin is attached by about twenty-two little points to the side of the dura mater, from this circumstance forming the scolloped or toothed appearance which gives the ligament its name. The ligamentum denticulatum is almost entirely covered by the arachnoid; it separates the anterior from the posterior roots of the spinal nerves. It preserves the spinal cord from concussion in sudden lateral movements of the body. The ligamentum denticulatum is situated between the dura mater and the pia mater; from this reason some have conceived it to be formed by the arachnoid, but it is generally considered, at the present day, that it is of a perfectly distinct structure.

The nervous system in general is, in the present day, divided into two grand parts, for the purposes of description. One, called the cerebro-spinal, containing the nerves of animal life; the other, the ganglionic, which comprises the nerves of organic life. This latter, in man, is represented by the sympathetic nerves and their adjuncts. All the vertebrata have the two systems developed in every individual, but the animals of a lower range, such as the crustacea, have no distinct cerebro-spinal system, though the ganglionic is in general sufficiently well developed.

Before entering upon a detail of the cerebro-spinal system, it will be necessary to say a few words of the various substances of which it is composed.

The white or *medullary* substance is found in the interior of the cerebrum and cerebellum, but on the exterior surface of the medulla spinalis, medulla oblongata, pons varolii, crus cerebelli, and crus cerebri. It is composed of an immense number of small tubes or fibrilæ, which never communicate with one another, although they occasionally interlace. The white substance seems only (as far as can be known) to act the part of a conductor to the various nervous manifestations exhibited by the gray. The fibres of white substance have been supposed to terminate in loops, but this is not as yet proved.

The *cineritious* or gray substance forms the external layer of the cerebrum and cerebellum, but it is found internally in the crura cerebri and crura cerebelli, the pons varolii, medulla oblongata, and medulla spinalis. The gray substance is composed of small, circular globules, which do not in any part present the appearance of radiating fibres. The structure is distinctively called *vesicular.* The gray substance has been supposed to owe its colour to the numerous minute vessels ramifying through it. It is the seat of all the nervous manifestations, such as sensation, motion, volition, the powers of the mind, memory, &c., and entirely surrounds the extremities of the fibrillæ of the medullary substance; it covers the whole brain with a layer, varying from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch in thickness. Its surface is closely adherent to the pia mater by cellular tissue and vessels, to which Ruysch has given the name of *tomentum cerebri.*

The yellow substance, which, as well as the black, is but a modification of the gray, may be seen in the lower part of the posterior cerebral lobes and in the cerebellum.

The black substance is seen, of a semilunar form, on cutting across the crura cerebri, and is here called the *locus niger.* It is also seen in the tuber cinereum and infundibulum.

THE BRAIN.

The brain is divided, for the purposes of description, into the cerebrum, cerebellum, cerebral protuberance (or pons varolii), and medulla oblongata. The cerebrum is nearly eight times the size of the cerebellum, whilst this latter is about eight times as large as the cerebral protuberance. The weight of the whole brain in the adult is about 48 ounces, or 49 ounces in the male and 47 ounces in the female. In some rare instances the brain has been found to weigh 64 ounces.

The cerebrum, into which are prolonged the anterior pillars of the spinal cord, of which, indeed, it may be considered the terminal expansion, occupies the upper and principal portion of the cranium. It is divided, above by the falx major, below by the great longitudinal fissure, into two lateral divisions, called hemispheres, and each of these is subdivided inferiorly, into three lobes, the anterior, middle, and posterior; the two former are separated by a distinct deep impression, called the *fissure Sylvii*; but between the middle and posterior there is no distinct line of demarcation.

The anterior lobes of the cerebrum rest on the orbitar plates of the frontal bone, the lesser wings of the sphenoid, and the cribriform plate of the ethmoid.

The middle lobes rest upon the greater wings of the sphenoid, and the petrosal portions of the temporal bones, which conjointly form the middle fossa of the cranium.

The posterior lobes rest on the tentorium. On the surface of each hemisphere are seen convex ridges running in various directions, named *gyri*, or convolutions, the fissures between them being called *sulci*, or grooves.

The gyri, or convolutions of one side, have but a general resemblance in figure to those of the other. The difference in appearance is more marked as the brain is better developed, and is more apparent in man than in the inferior animals.

On gently separating the two hemisphere superiorly, the corpus callosum is seen.

On slicing away the substance of the brain, at about an inch in depth, from the top of half the hemispheres, we bring into view on each side an irregular, small, oval space, termed by anatomists the *centrum ovale minus*. By this section we see the white and gray substance, showing their peculiar arrangement. We also see a few small bloody points, occasioned by the division of the minute vessels of the brain. We are able to note also the depth and various shapes of the sulci.

By slicing away the substance of both the hemispheres to a level with the corpus callosum, we bring into view a larger, more regular oval space, called the *centrum ovale* *majus*. We now see, in this situation, the converging fibres of the two hemispheres, passing from one to the other, and forming the corpus callosum. These fibres can be traced into the medullary substance which lies external to the corpus callosum as very delicate, transverse, white lines, *lineæ transversæ*.

The *corpus callosum*, so called from its hardness (which is considerable as compared with that of the other cerebral substances), is formed by the converging fibres of the hemispheres, and has been from that circumstance called the *commissura magna*, or *maxima cerebri*, the great commissure of the brain. Laterally it is continuous with the white substance of the hemispheres, anteriorly it is reflected downwards, forming a rounded margin, which terminates on the base of the brain in the form of *lamina cinerea*, becoming continuous with the under surface of the corpora striata. It passes over the optic commissure, with which it is slightly blended, and is lost on the tuber cinereum and substantia perforata antica. Posteriorly the corpus callosum is continuous with the fornix in the middle, and the hippocampi majores at the sides. Inferiorly its surface covers the bodies of the lateral ventricles, and in the middle it is attached to the septum lucidum, whilst under its posterior margin is the fissure of Bichat.

The superior surface of the corpus callosum presents a longitudinal groove called the *raphé*, which runs along its centre, and at either side of this is an elevated ridge running along its side, named *striæ longitudinales*, or *nerves* of *Laucisi*, whilst externally it is marked by transverse lines, called *lineæ transversæ*. On this surface run the anterior arteries of the cerebrum, which having turned over the anterior rounded margin of the corpus callosum, pass on its upper face from before backwards, parallel with one another, and are here called *arteriæ corporis callosi*. The corpus callosum is composed entirely of white substance, and is considerably thicker posteriorly than anteriorly.

On cutting down longitudinally into the white substance on either side of the corpus callosum, we make an opening into the *lateral ventricle*.

Each *lateral ventricle* is described as consisting of a body and three cornua, anterior, posterior, and middle; the body is of an irregular shape, and bears no resemblance to any known object, although it has been likened to a ram's horn. Anteriorly it is continuous with the anterior cornu, posteriorly with the posterior cornu. Externally lie the cerebral substances of the hemispheres. Internally is the septum lucidum. Its roof is formed by the corpus callosum, whilst its floor is formed by the following parts, in the order mentioned from before backwards: the corpus striatum, tænia semicircularis (on which lies the choroid plexus), thalamus opticus, and the lateral thin margin of the fornix.

The *corpus striatum* (plurally, corpora striata), is a gray, pear-shaped body, of which the larger end is anterior, and close to its fellow of the opposite side, whilst the smaller extremity is posterior and divergent, being separated from its fellow by the thalami optici. Internally it is composed of both gray and white striated matter, so mixed as to give it the appearance from which it derives its name. The white matter seen in it is a prolongation of the anterior pyramids, which derive their last increase of substance from these bodies previously to expanding into the cerebral hemispheres. From this circumstance the corpora striata have been called the superior cerebral ganglia, or ganglia of increase.

The *tænia semicircularis* is a small, thin, straw-coloured band of nervous substance, which separates (externally) the thalamus opticus from the corpus striatum; it may be traced for a short way into the descending cornu in which it ceases.

The *choroid plexus* is a congeries of blood-vessels and cellular tissue which passes from the foramen of Monro over the body of the lateral ventricles through the descending cornu of the lateral ventricle to the pia mater at the base of the brain. At the foramina of Monro the two choroid plexuses unite to form the velum interpositum, of which we shall speak when we treat of the third ventricle. The thalamus opticus and the fornix we will leave for the present.

The *anterior cornu* of the lateral ventricle appears like a simple groove in the cerebral substance. Its direction is forwards and outwards, diverging from its fellow of the opposite side.

The *posterior cornu* is in shape like a depression, caused by a finger being pressed into the substance of the posterior lobe; it is thence called the digital fossa. Its direction is backwards and inwards, converging to the opposite cornu; it presents a slight elevation (derived from the corpus callosum) on its floor, called the *hippocampus minor.*

The *descending cornu* describes a considerable curve, the general direction of which may be remembered by the word BODFI; its course being backwards, outwards, downwards, then forwards and inwards.

In the descending cornu are seen the following parts. The side and part of the under surface of the thalamus opticus, the choroid plexus, the hippocampus major, the corpus fimbriatum, the fascia dentata, the pes hippocampi, and the pes accessorius.

The *hippocampus major* somewhat resembles in shape a cerebral convolution; from its twisted form it has also been called the *cornu ammonis.* It presents a curve of which the convexity is outwards and the concavity inwards, and at its inferior and anterior extremity it presents the *pes hippocampi.* This latter is a row of small elevations from three to five in number, and somewhat resembling the foot of an animal. External to the part where the cornu makes its curve forwards there is seen another slight elevation, called the *pes accessorius.*

The *corpus fimbriatum* or *tænia hippocampi,* is a thin falciform process of white substance, forming the free anterior border of the hippocampus major. It gradually becomes narrow and ends in a point a little behind the pes hippocampi.

The *fascia dentata* is a narrow line of gray substance situated below the lower border of the corpus fimbriatum; its edge is marked by several small transverse notches, whence it has its name.

The *hippocampus major* is found to be a lateral continuation of the posterior border of the corpus callosum and fornix, and, in the same way, the corpus fimbriatum, or, as it is sometimes called, the tænia hippocampi, is a continuation of the posterior extremity of the fornix.

The lateral ventricles are separated from one another by a thin longitudinal septum, composed of nervous substance passing from the corpus callosum above, to the fornix below, named septum lucidum. This *septum lucidum* is considerably deeper anteriorly than posteriorly, and contains between its two layers a small cavity, lined with a peculiar serous membrane, and called the fifth ventricle. At the anterior part of the septum lucidum, but beneath the narrow anterior part of the fornix, is seen a small hole, called the foramen of Monro, through which, on each side, passes the choroid plexus, the two foramina leading to a single foramen behind the anterior pillars of the fornix through which both choroid plexuses pass, to expand on the roof of the third ventricle, and form the *velum interpositum*.

The *thalami optici* are two large, firm, oblong bodies, nearly an inch and a half long, by three fourths of an inch wide and deep; they are composed of white and gray matter, the latter being internal, and through their centre pass the fibres of the anterior pyramids, from which circumstance they have been called the *posterior cerebral ganglia;* they form the middle ganglia of increase of the anterior pyramids of the spinal cord.

The boundaries and relations of the thalami optici may be given as follows:

Internally they are bounded by the third ventricle, across which they are connected by the middle and posterior commissures. Externally they form a portion of the roof of the descending cornu of the lateral ventricle. Anteriorly the optic thalami are continuous with the corpora striata; posteriorly they are bounded by the descending cornu, and have developed upon them two rounded eminences, called the *corpus geniculatum externum* and *internum*, from the former of which the optic nerve takes one of its origins. Superiorly, the thalamus opticus is partially covered by the posterior pillars of the fornix, the remainder of its surface forming a part of the floor of the body of the lateral ventricle, whilst inferiorly, it is connected with the crura cerebri, as well as slightly with the corpora albicantia.

The thalami optici are also connected at their posterior part by small peduncles with the pineal gland, and the nates.

The *fornix* is a triangular lamina of white substance, with its *apex* directed forwards and its *base* backwards, the former dividing into two round bands, which pass almost vertically downwards behind the anterior commissure to terminate in the corpora albicantia, the latter being continuous with the corpus callosum in the middle, and with the hippocampus major and corpus fimbriatum at the sides; superiorly, the fornix is attached to the septum lucidum; its sides slightly overlap the optic thalami, whilst its inferior surface covers the third ventricle, from which it is partially separated by the velum interpositum. On the under surface of the fornix are seen some longitudinal lines, to which the term *psalterium*, or *lyra*, has been applied, from a supposed resemblance to the strings of a lyre.

The *third ventricle* (which may be easily shown by cutting through and reflecting, and removing the velum interpositum and the fornix) is a small narrow cavity lying between the optic thalami.

It is bounded anteriorly by the anterior commissure and the anterior crura, or pillars of the fornix, posteriorly by the posterior commissure, and the iter a tertio ad quartum ventriculum; its roof is formed by the fornix and velum interpositum; its floor (which is very short) is formed by the anterior termination of the corpus callosum, tuber cinereum and infundibulum, corpora albicantia, and locus perforatus (or pons Tarini); whilst its sides are formed by the thalami optici, and very slightly by the corpora striata. The middle or soft commissure crosses the middle of the third ventricle, and almost entirely fills its cavity. Two other commissures exist here, named anterior and posterior.

The *anterior commissure* is a medullary band, uniting the corpora striata, in front of the anterior pillars of the fornix.

The *middle commissure*, or commissura mollis, connects the two optic thalami externally together; it is so soft that it is generally found broken when the ventricle is opened. Between it and the anterior commissure, along the floor of the ventricle, is an opening, leading into the infundibulum terminating in a cul-de-sac, called the *iter ad infundibulum*.

The *posterior commissure* is a rounded white cord connecting the thalami optici posteriorly. It lies over the iter a tertio ad quartum ventriculum and under the pineal gland.

The *iter a tertio ad quartum ventriculum*, called also the *foramen commune posterius*, *aquæductus Sylvii*, and *canalis medius*, is a small canal, leading, as its name denotes, from the third to the fourth ventricle; it passes over the pons varolii and under the posterior commissure, nates and testes, and pineal gland.

The *velum interpositum* is a triangular, membranous expansion, in which ramify numerous minute veins and arteries; its apex is continuous with the choroid plexuses which have entered the ventricle through the foramen commune anterius, whilst its base (which is posterior) is situated close to the fissure of Bichat, through which it passes. In it run the venæ Galeni, which finally unite into one, and which, with the inferior longitudinal sinus, combine to form the straight sinus.

The *foramen commune anterius* is that canal by which the lateral ventricles communicate with the third; it is shaped like the letter Y, the two superior bars of which are (in the brain) anterior, whilst the inferior is posterior. This is occasioned by the two chloroid plexuses, either of which has a separate foramen to pass through, afterwards uniting together and passing behind the anterior pillars or crura of the fornix as but one body.

Under the posterior part of the velum will be found the pineal gland, and inferiorly and somewhat posteriorly to this, the *corpora quadrigemina*.

These latter are four little, white, round, bodies, connected intimately with each other, of which the anterior and superior pair are called the nates, the posterior and inferior being named the testes, from a fancied resemblance to the arrangement of those parts. The *nates* are connected with the optic thalami on each side by a thickish peduncle; the *testes* being continuous with the cerebellum by two peduncles, called the *processus é cerebello ad testes*. Between the processus é cerebello ad testes is stretched a thin layer of medullary substance, called the *valve of Vieussens*. This latter forms a portion of the roof of the fourth ventricle. The nates and testes are bounded above and behind by the fissure of Bichat, whilst anteriorly and inferiorly they are bounded by the iter a tertio ad quartum ventriculum.

The *pineal gland* is a small oval portion of gray matter, about the size of a small pea. Its only connexion to the brain is by two small delicate peduncles, which run from it to the optic thalami. It rests upon the groove and upper part of the nates. It contains often a little gritty matter, composed of phosphate of lime. It occasionally appears divided into two lobes. It has also been sometimes called the *conarium*, and the earthy matter has been named *acervulus cerebri*. It was supposed by Descartes to be the seat of the soul.

THE CEREBELLUM.

The *cerebellum* (or little brain) is situated in the posterior occipital fossæ, resting slightly upon a portion of the temporal bone, and it is covered in by the tentorium. A slight line of demarcation separates it externally into two lobes, but internally there is a very manifest line of division. Inferiorly the falx minor assists in the separation.

Externally the cerebellum is not covered with convolutions like the cerebrum, but appears to be formed by a number of lamellæ or plates, with sulci between them. When cut into on either side perpendicularly the arrangement of the white and gray matter is seen; these are arranged in such a way as to give an arborescent appearance, thence called the *arbor vitæ*, the white substance forming the stalks, and the gray the leaves of this arrangement.

When cut across at about the outer third we see in the middle of the medullary substance an oblong patch of gray matter with a jagged border, which is called the *corpus rhomboideum* or *dentatum*, and is supposed to be a ganglion of increase to the formative fibres of the cerebellum.

The *superior vermiform process* of the cerebellum is a slightly elevated ridge running along the middle of the superior surface of the cerebellum between the two lateral lobes, which it connects superiorly.

The *inferior vermiform process* is situated inferiorly, and runs from before backwards between the two lateral lobes, which it connects.

The *flocculus*, or *pneumogastric lobule*, is situated on the anterior border of the cerebellum, close to the origin of the eighth pair, whence its name.

The *linguetta laminosa*, is a small process of gray substance, extending from the cineritious matter of the cerebellum to the valve of Vieussens.

The *uvula* and *tonsils* are three processes of the cerebellum, situated on its anterior surface, and forming the posterior boundary of the fourth ventricle. They resemble those parts in the throat when in a swollen state.

The peduncles of the cerebellum are four, two of them (the superior) are the *processus é cerebello ad testes*, the other two being the *corpora restiformia*.

These latter (which will be fully described with the medulla oblongata) form part of the lateral boundaries of the fourth ventricle.

The crura cerebelli are two thick rounded cords (very short), leading from the substance of the cerebellum on each side to the pons varolii. They form part of the great transverse commissure of the cerebellum.

The *fourth ventricle* is a small cavity situated between the medulla oblongata and the cerebellum.

It is bounded laterally by the corpora restiformia, and the processus é cerebello ad testes. Above by the testes and the iter a tertio ad quarto ventriculum; below by a small process of pia mater, and arachnoid closing its cavity. Posteriorly by the valve of Vieussens above, and the uvula and tonsils below, and anteriorly by the posterior surface of the medulla oblongata, across which are seen some delicate white striæ, which are the origins of the auditory nerve. This surface comes to a point (between the two restiform processes) inferiorly, which has been called the *calamus scriptorius*, from a slight resemblance that it has to a writing pen.

At the extreme point of the pen is seen a small cavity, called (from its describer) the *ventricle* of *Arantius*.

The little projection of the pia mater inferiorly into this ventricle has been called the choroid plexuses of the fourth ventricle.

We will now proceed to the description of the base of the brain, with which we will describe the cerebral protuberance in its proper place.

Before proceeding to examine the base of the brain, care should be taken that its external edge should be supported all round, so as to give it, as far as possible, the same flat appearance as it has during life. Otherwise the sides and posterior part will so far separate from their natural position that a distorted appearance of the parts will ensue.

Most anteriorly will be perceived the great longitudinal fissure dividing the anterior lobes of the brain, and on gently separating these we shall see the anterior extremity of the corpus callosum.

On each side of this fissure is a groove which lodges the olfactory nerve and its bulb.

In front of the optic commissure in the mesial line is the *lamina cinerea,* a continuation of the corpus callosum.

Further back and in the middle line may be seen the *commissure* of the *optic nerves,* the anterior diverging nerves going to the eye, whilst the posterior, converging forwards, may be traced over the crura cerebri to their origin in the optic thalami and corpora quadrigemina.

External to the optic commissure may be observed a triangular space, of a brownish colour, called the *substantia perforata antica;* a portion of the inferior surface of the corpora striata. It has its name from its being perforated by several minute tufts of vessels, which pass through it to supply the interior of the brain.

In this situation may be seen the three origins of the olfactory or first nerve, its most internal one being from the internal border of the substantia perforata antica, its middle one from a little tubercle of the gray substance of the anterior lobe, whilst its external root runs for a short distance along the fissure of Sylvius, in which it terminates.

The *fissure of Sylvius* is a deep grove, which separates the anterior from the middle lobe. It commences internally at the substantia perforata antica, and it runs outwards and very slightly forwards to the edge of the brain. A little before its internal termination this fissure divides into two, which, by their divergence from one another, partially enclose a small group of convolutions, called the *Island* of *Reil.*

Along the fissura Sylvii runs the middle cerebral artery.

Immediately behind the optic commissure is situated a small dark reddish eminence, called the *tuber cinereum;* from the middle of which (in this position of the brain) projects the infundibulum. This latter is, as its name denotes, a small funnel, and leading from the third ventricle to the pituitary gland, or more correctly body. The infundibulum is, however, not pervious, excepting at its upper part, the lower being closed by a small fold of the serous membrane of the ventricle.

The *pituitary body* (the use of which is unknown) is situated in the sella turcica of the sphenoid bone. It is bounded laterally by the cavernous sinuses, and has no communication with the nose. Its shape is oval.

Externally to the tuber cinereum and under the edge of the middle cerebral lobe is seen a fissure, through which the pia mater enters the descending cornu of the lateral ventricle, as the choroid plexus.

The tuber cinereum forms a portion of the floor of the third ventricle, and is attached laterally to the converging optic nerves.

Behind the tuber cinereum and infundibulum are seen two small round white bodies, called the *corpora albicantia, pisiformia*, or *mamillaria*, but generally by the first name; they are composed of white matter externally and gray internally, and are the terminations of the anterior pillars of the fornix.

Behind the corpora albicantia is seen a small triangular piece of gray substance, called the *locus perforatus posticus*, or *pons Tarini*. It is perforated by numerous small blood-vessels. It forms a portion of the floor of the third ventricle. It is bounded laterally by the crura cerebri.

The *crura cerebri* are two short, thick, rounded cords, leading from the pons varolii to the optic thalami. They are principally composed of medullary substance, but in their interior is a semilunar mass of gray substance, which, from its dark colour, is called *locus niger*.

The crura cerebri are composed of the anterior columns of the spinal cord, increased prodigiously by additions from the ganglion of increase in the pons varolii. From the internal surface of the crura cerebri, just after their emergence from the pons, arise the third pair of nerves, called *motores oculorum*. They have been traced in the crura to the locus niger.

Immediately behind the crura cerebri is seen the *pons varolii*. This, which is also called the *cerebral protuber-*

ance, nodus cerebri, or annular protuberance, is a square mass, the breadth of which is about equal to its length and depth. From its appearing to unite the cerebrum and cerebellum, it has been sometimes called the "nodus encephali." Its anterior surface (which, when we look at it in examining the base of the brain, is superior) rests upon the basilar process of the occipital bone, and is slightly grooved in its centre by the basilar artery. Its posterior surface is groved by the iter a tertio ad quartum ventriculum. Its superior edge is connected with the crura cerebri which pass out from it, whilst posteriorly it is in relation with the medulla oblongata, and laterally it is continuous with the crura cerebelli.

The pons varolii is somewhat complex as to its structure, and is rendered somewhat more so by the various parts in relation with or passing through it. The external part of the pons, both anteriorly and posteriorly, may be considered as forming the great commissure of the cerebellum. This portion is composed of medullary substance, the fibres of which are transverse. Internally, the pons varolii is filled by a quantity of gray ganglionic substance, through the centre of which the fibres of the corpora pyramidalia and olivaria pass from behind forwards and upwards to form the crura cerebri. These fibres are greatly increased in this situation as to number, and this circumstance has caused the pons varolii to be considered as the first or cerebellar ganglion of increase to the spinal cord. It must, however, be borne in mind that the posterior pillars, or corpora restiformia, do not enter into the pons varolii at all. By the sides of the pons varolii are seen the fourth nerves coming from their origin in the valve of Vieüssens, and at its point of junction with the crus cerebelli of each side the fifth nerve is seen emerging.

The *crura cerebelli* are two thick medullary cords, leading from the pons varolii to the lateral portions of the cerebellum, one on each side. They are composed of medullary substance.

Immediately behind the pons varolii is seen the *medulla oblongata.* This is the upper end of the spinal cord, and is considerably thicker and more expanded than the rest. Although there is no distinct line of demarcation that separates it from the rest of the spinal cord, we are accustomed to consider about the superior inch and a quarter as belonging to the medulla oblongata, whilst the rest is described as the cord. The medulla oblongata is about five eighths of an inch broad and half an inch thick. It is divided by an anterior, a posterior, and two lateral grooves into four rounded bodies, called pyramids, of which the two anterior are called corpora pyramidalia, and the two posterior corpora restiformia. Between these two, at the upper part of the lateral groove, is seen on each side a little oblong elevation, called from its shape the corpus olivare; and lastly, between the corpus olivare and restiforme is seen a narrow white line, traceable a considerable way down the cord, called the respiratory tract of Sir Charles Bell. The general figure of the anterior part of the medulla oblongata is rounded, of the posterior flattened.

The *corpora pyramidalia*, or anterior pyramids, are situated close together, being only separated by the anterior sulcus. About three fourths of an inch below the pons the two decussate, the fibres of the right one passing to the left, and *vice versâ*. This helps to explain the cause of paralysis occurring on the opposite side of the body to that of the brain affected by accidental or morbid lesion. From the extreme summit of the corpora pyramidalia arise the sixth nerves.

The *corpora olivaria* are composed of white substance externally, and contain, in their interior, a small leaf-like patch of gray matter, named *corpus dentatum olivare*, which has given them the name of ganglia of increase of the medulla oblongata. The fibres of these bodies, as well as those of the corpora pyramidalia, pass through the pons varolii. Between the corpora pyramidalia and olivaria arises the ninth pair of nerves.

The *corpora restiformia* are composed of medullary substance almost entirely; they are close together below, but above diverge from one another to pass at once into the lateral lobes of the cerebellum. From this they have been sometimes called the processus é cerebello ad medullam. They form by their divergence the calamus scriptorius, and bound laterally the cavity of the fourth ventricle. From the groove between the corpora olivaria and restiformia arise the seventh and the first two divisions of the eight nerves, the former being superior. External to the latter is seen the flocculus or pneumogastric lobule of the cerebellum.

Before leaving the brain, I shall say a few words on its mode of evolution from the spinal cord, as well as on the modes of correspondence and connexion between the two sides.

The corpora pyramidalia, as before mentioned, pass first through the pons varolii, their first ganglion of increase, which they leave considerably augmented, as the crura cerebri. They then pass into the optic thalami, their second (the inferior cerebral) ganglion of increase; from this they pass into the corpora striata, or superior cerebral ganglion of increase, where they receive their last augmentation, before they are evolved into the cerebral hemispheres.

The corpora olivaria pursue a similar course to the pyramidalia; but in addition to passing through the other ganglia of increase, the major part of their fibres go through an oval nucleus situated in their centre, called the olivary ganglion or corpus dentatum, which thus forms their first ganglion of increase.

The corpora restiformia spread out into the cerebellum, without having any relation with the pons, and after passing through their single ganglion of increase (the corpus rhomboideum), are evolved into the cerebellar hemispheres.

The former parts, which from their situation and distribution have been called the diverging fibres, include all those parts which are evolved into the cerebral hemispheres. The next which we shall speak of are the converging fibres, or those which bring all the parts of the brain into communication and common consent of action with one another.

They are the following:

The corpus callosum, or great commissure, connects the two hemispheres of the cerebrum.

The anterior commissure connects the corpora striata.

The middle, or soft commissure, connects the optic thalami.

The posterior commissure also connects the optic thalami at their posterior part.

The pons vorolii connects the cerebellar hemispheres in the same way as the corpus callosum the cerebral.

These are all transverse commissures, and connect the hemispheres one with the other.

The fornix is an antero-posterior commissure, connecting the anterior with the posterior parts of the cerebrum.

The peduncles of the pineal gland are also commissural.

The processus é cerebello ad testes and the valve of Vieusseus, are both antero-posterior commissures, and serve to connect parts of the cerebrum and cerebellum.

The septum lucidum is considered to be a perpendicular commissure, connecting the corpus callosum and the fornix together.

Most of these commissures are composed of white substances, but the soft commissure and the valve of Vieussens, as well as the pineal peduncles, are composed of gray.

Many actions and thoughts which, from the peculiar arrangement and perfect individuality of the hemispheres, might have been expected to be double, are by this free communication made single; and thus, so to speak, nothing is done by one side of the body that is not immediately perceived by the other.

The *spinal cord,* medulla spinalis, or spinal marrow, is all that part of the cerebro-spinal axis which is situated below the medulla oblongata. From this point it extends, passing down the spinal sheath, to the first or second lumbar vertebra, at which spot it terminates in the cauda equina. In early life it extends almost the whole length of the spinal column (as indeed it does permanently in many animals), but it rapidly assumes its permanent condition in the human species. When cut across, its shape is ovoid, the long axis being transverse, and its size varies in different parts of the canal, it being narrowest in the middle of the dorsal region, and broadest at the medulla oblongata, its next largest part being just before it terminates, and its next opposite the sixth and seventh cervical vertebræ.

It is composed of both white and gray matter, the latter being internal and the white external.

The spinal cord presents six grooves, of which one is anterior and one posterior, the four others being at the sides. The sulcus longitudinalis anterior is tolerably wide, but not so deep as the posterior; it runs through about three eighths of the spinal cord, but does not pass down to the gray substance.

The sulcus longitudinalis posterior, narrower but deeper than the anterior, extends nearly half way through the cord, and terminates in the gray substance.

The anterior lateral groove is a narrow line on the side of the cord from which arise the anterior or motor roots of the spinal nerves; it only grooves the white substance.

The posterior lateral groove, parallel with but posterior o the preceding, is larger and proceeds into the gray ubstance; from it arise the posterior or sensitive branches of the spinal nerves.

By these grooves the spinal cord is divided into three olumns on each side—the anterior, posterior, and lateral. On the anterior part of these last is seen the narrow white ine of the respiratory tract of Sir Charles Bell.

The gray substance is found, on making a section, to be rranged in a crescentic shape in each hemisphere, one orner of the crescent being anterior and shorter, the other longer and reaching to the roots of the posterior pinal nerves. The two crescents are arranged so that hey are, as we may say, back to back, and are connected o one another by a narrow band of gray substance, so hat they produce an appearance not very unlike a capital etter H.

The white matter entirely surrounds the gray, excepting t the roots of the posterior nerves and at the bottom of he posterior sulcus. The two sides of it are only conected anteriorly at the bottom of the anterior groove, and his, from the transverse direction of the fibres, is someimes called the spinal commissure. The medullary fibres posteriorly are nearly all longitudinal.

The arteries that supply the brain arise from two sources n each side, the *internal carotid* and the *vertebral*. The nternal carotid, which divides at the anterior part and side f the sella turcica, gives off:

1. The *ophthalmic*, supplying the eye and its appendages, which it reaches, through the foramen opticum.

2. The *anterior cerebral*, which runs forwards and upwards parallel to its fellow of the opposite side, over the

anterior border of the corpus callosum, on the superior surface of which it runs as the *arteria corporis callosi.* It is connected with its fellow by a short branch, the *anterior communicating* artery.

3. The *middle cerebral* artery, which runs along the fissure of Sylvius, terminating a little beyond its outer end. It is the largest of the branches of the internal carotid.

4. The *posterior communicating,* which runs almost directly backwards to join the posterior cerebral, thus completing the circle of Willis on each side.

The *vertebral artery* of each side, after entering the skull at the foramen magnum, first gives off a *meningeal* branch or two to supply the dura mater, the anterior and posterior spinal arteries to supply the cord, and then the *inferior,* or *posterior cerebellar* artery, which is distributed to the lower and back part of the cerebellum; after which it unites with its fellow of the opposite side to form the basilar artery, which lies on the basilar process of the base of the skull.

The *basilar artery* runs forwards and upwards, giving off transverse branches to the pons, internal ear, and parts of the base of the brain, and finally divides at the upper border of the pons varolii into its four terminal branches. The *anterior* pair of which are, the *posterior cerebral,* and the posterior, the *superior* or *anterior cerebellar.* These two are separated on each side by the third pair of nerves.

The *circle of Willis* is a very curious arterial communication, by means of which all the four great cerebral arteries anastomose very freely with one another.

This space is not circular, but heptagonal in shape, it being formed in front by the anterior communicating artery, next to which, on each side, lie the anterior cerebral arteries, the posterior communicating arteries connecting these with the posterior cerebral arteries which form the posterior angle.

Within the circle of Willis are seen the following parts: from before backwards, the lamina cinerea, the optic commissure, tuber cinereum and infundibulum, corpora albicantia, locus perforatus, and a small portion of the crura cerebri, with the roots of the third pair of nerves.

The arteries of the brain are remarkable for their tortuous course, and free anastomosis with one another, their dividing into minute branches previously to entering the substance of the brain, and, lastly, for the thinness of their coats, the middle one being apparently deficient, and having no regular venæ comites.

The arteries of the brain are also extremely liable to ossific deposit in old age.

The veins of the brain empty themselves into the various sinuses, which finally pour their blood into the internal jugular veins.

NERVES.

The nerves are white medullary cords, necessary to sensation, motion, and all the functions of life. They are composed of very minute fibrillæ, called nervous fibres, each fibre having its sheath, called neurilemma. These fibres are next bound together by their neurilemma, forming primary fasciculi. These primary fasciculi being bound together by cellular tissue to form secondary fasciculi, several of which, aggregated together, form a nerve, which is contained in a strong fibrous sheath that keeps all its parts together, and to which the term neurilemma is ordinarily applied.

The ultimate nervons filaments are now considered as tubular, containing within their cavity a soft substance, which may be easily squeezed out from their cut ends.

The ganglionic filaments have, to all appearance, no internal cavity; they are considerably less in diameter than those of the cerebro-spinal system.

There is considerable doubt about the termination of the nervous filaments, some considering them as ending in loops, others thinking that they terminate in free ends, either enlarged or so small as to be lost to sight in the tissues, whilst some evidently terminate in ganglionic corpuscles or Pacinian bodies. We shall not be very far off the truth if we consider each nerve as double; its terminal end being a loop; its originating end from two nerve-corpuscles. The origin of all the nerves of animal life being in the cerebro-spinal system, and that of the nerves of organic life in the ganglionic or sympathetic system.

As far as can be ascertained, the sympathetic nerves communicate with one another by means of their ganglia; but the cerebro-spinal nerves, though they often interlace, forming plexuses, never communicate one with another.

Many of the cerebro-spinal nerves have enlarged portions, called ganglia. These, besides containing many interlacing fibres, have also several nerve or ganglionic corpuscles in their interior, from which may be seen arising additional nervous fibres. The precise use of the ganglia is, however, unknown.

The sympathetic ganglia are generally larger than the cerebro-spinal, are contained in a fibrous capsule, are red in their colour (instead of white), and are very vascular. They are composed of both gray and white matter, containing many ganglionic corpuscles, and may be looked upon as so many nervous centres.

The cerebro-spinal nerves, of which we are now about to speak, are generally divided into two sets, the cerebral and spinal, the former containing nine pairs, the latter thirty-one pairs of nerves.

CEREBRAL NERVES.

The *first pair*, or the *olfactory nerves*, take their origin by three roots, the outer and inner one medullary, the central one cineritious. The first, which is longest, arises from the inner end of the fissure of Sylvius; the second, from the substantia perforata antica; the central or gray portion, from the substance of the anterior lobe. They soon unite, forming a white triangular cord, lodged in a groove at the base of the anterior lobe, about half an inch from the median fissure; and covered by the arachnoid only on their under surface. Each cord is then expanded upon the cribriform plate of the ethmoid bone, to form the olfactory bulb, composed of white and gray matter, which gives out numerous medullary filaments, to pass through the cribriform plate of the ethmoid bone. These filaments, which receive an investment from the dura mater as they pass out of the skull, are distributed upon the septum, roof of the nose, and the superior turbinated bones, by three series of filaments.

The *second pair*, or *optic nerves*, arise from the corpus geniculatum externum and nates. They wind round the crura cerebri, and unite, forming the optic commissure in front of the pituitary fossa, and between the anterior clinoid processes; they then separate and diverge, pass through the foramen opticum, into the orbit, perforate the sclerotica, to the inner side of and below the axis of the eye, then pass through the choroid, and are lost or terminate in the retina.

In the commissure, some of the fibres of each nerve cross to the opposite side; those on the outside of each nerve seem to pass forwards on the same side, to their destination. A transverse section of the optic nerve in the orbit presents a dark central spot, named *porus opticus*, dependent upon the arteria centralis retinæ, which enters this nerve and runs along its centre.

The *third pair*, or *motores oculorum*, arise from the inner edge of the crura cerebri; they always run downwards and forwards, between the posterior artery of the cerebrum and anterior artery of the cerebellum, then pass along the inner side of the outer wall of the cavernous sinus, then traverse the sphenoidal fissure, enter the orbit between the heads of the external rectus, and divide into two portions, superior and inferior. The superior portion gives off a branch to the superior rectus, and another to the levator palpebræ superioris; the inferior portion, larger, gives off three branches, one to the internal rectus, one to the inferior rectus, and the third to the inferior or oblique muscle. The last gives a filament to the lenticular ganglion. They all run along the ocular surface of the muscles. In the cavernous sinus, this nerve is at first situated higher than the other nerves, but, on passing into the orbit, it is below them; just before entering, it communicates with the carotic plexus and ophthalmic division of the fifth.

The *fourth pair*, or *pathetici*, arise from the valve of Vieussens, immediately beneath the tubercula quadrigemina; they run along the side of the pons varolii, perforate the dura mater, pass within the outer wall of the cavernous sinus, then through the sphenoidal fissure, and are distributed to the trochlearis, or superior oblique muscle of the eye. They are the smallest and longest of the cerebral nerves within the cranium. In the orbit they mount up over the levator palpebræ muscle, lying between it and the periosteum; and, as they enter the orbit, are the highest of the orbital nerves. Arnold describes a small reflected branch from this nerve in the cranium, which runs back upon the tentorium almost as far as the lateral sinus.

The *fifth pair* of nerves, or *trigemini*, resemble spinal nerves, being both for motion and sensation, and having, like them, a double origin. They seem to emerge from the junction of the pons varolii with the crura cerebelli. The anterior or smallest fasciculus may be traced to the corpus pyramidale. The large posterior fasciculus, composed of nearly a hundred filaments, is derived from the corpus restiforme, conferring sensation. The nerve of each side, passing forwards, enters a sheath of dura mater upon the petrous bone, and the posterior root, by expanding, forms the semilunar or Casserian plexus, or ganglion, on the anterior surface of the petrous portion of the temporal bone, and part of the sphenoid bone. From this plexus three trunks are given off, the *ophthalmic*, *superior*, and *inferior maxillary*.

The *ophthalmic trunk*, the smallest of the three, and most internal, runs along the inner side of the outer wall of the cavernous sinus, below the third and fourth nerves, communicating slightly with the cavernous plexus, then separates into three branches, which perforate the dura mater separately, to enter the orbit by the sphenoidal fissure. They are the following:

1. The *lachrymal* branch, smallest and lowest of the three, passes between the orbit and external rectus, to be distributed to the lachrymal gland, external canthus, and upper eyelid. It communicates, by small twigs, with the superior maxillary, and a twig or two through the malar bone, to communicate with the deep temporal nerves.

2. The *frontal* branch, largest, passes along the orbit, between it and the levator palpebræ superioris; midway in its orbital course it divides into two branches, the *supra-orbital* and *supra-trochlear*; the latter emerges above the trochlea of the superior oblique, and runs beneath the muscles, then perforates the occipito-frontalis, and is distributed to it and the integuments of the head; the other filament passes out at the supra-orbital notch, is distributed to the occipito-frontalis, and parts about the forehead, communicating, as well as the other, with the temporal branches of the portio dura.

3. The *nasal* branch passes between the two heads of the external rectus, then crosses over the optic nerve, communicating in that spot with the lenticular ganglion, and giving off two ciliary branches, which accompany the ciliary nerves of the lenticular ganglion; and at the

inner wall of the orbit dividing into two branches, called *nasal* and *infra-trochlear*. The nasal twig emerges at the foramen orbitarium internum anterius, enters the cranium, and, passing down in the anterior foramen of the cribriform plate of the ethmoid bone, is distributed to the septum and extremity of the nose. The infra-trochlear twig is distributed to the root of the nose, the tensor tarsi, and lachrymal sac, upper eyelid, and caruncula, and communicates with the supra-trochlear nerve.

The *superior maxillary nerve* leaves the cranium by the foramen rotundum, then crosses the spheno-maxillary fossa, passes along the infra-orbitar canal, escapes at the infra-orbitar foramen, under cover of the orbicularis palpebrarum and levator labii superioris, and is ultimately distributed upon the cheek.

In its course it gives off the following branches:

1. An *orbital* branch, which communicates with the lachrymal, and sends twigs to the orbicularis palpebrarum and skin, and a malar twig, which perforates the malar bone, and anastomoses with the deep temporal nerves.
2. Two descending branches, communicating with Meckel's ganglion.
3. Four or five *posterior dental* branches, which perforate the tuberosity of the superior maxillary bone, to supply the molar teeth, and one filament which runs superficially to supply the gums.
4. *Anterior* dental, for the supply of the bicuspid, canine, and incisor teeth. These nerves run partly along the walls of the antrum, partly within the bone.

Its terminating filaments communicate with the nasal branch of the ophthalmic and facial twigs of the portia dura, upon the cheek.

The *inferior maxillary nerve*, consisting of two separate portions, viz., the third trunk of the ganglion and the anterior root of the fifth, which had not entered into the structure of the ganglion, but lay beneath it towards the outer side, passes from the cranium by the foramen ovale of the sphenoid bone.

The two portions unite as soon as they pass through the foramen, but appear to separate almost immediately, in the form of two trunks.

The superior and smallest one gives off the following branches:

1. The *deep temporal* branches, two in number, distributed to the temporal muscle. They perforate the muscle, and communicate with the superficial temporal nerves.

2. The *buccal* branch, supplying the buccinator muscle and muscles of the cheek.
3. The *pterygoid* branch, chiefly to the internal pterygoid muscle.
4. The *masseteric* branch, for the supply of the masseter muscle.

Thus we observe that the muscles of mastication are supplied by the third division of the fifth pair.

The inferior trunk of the inferior maxillary nerve divides into three branches, the *gustatory*, the *temporo-auricular*, and *inferior dental.*

1. The *gustatory* nerve descends, first between the two pterygoid muscles, next between the internal pterygoid muscle and ramus of the lower jaw, then arrives upon the upper surface of the mylo-hyoid muscle, and outer surface of the hyoglossus, accompanies there the Whartonian duct, runs over the sublingual gland, and ultimately arrives at the tip and sides of the tongue, to be distributed to the papillæ. In its course it unites with the inferior dental nerve, by a large branch, and also with the chorda tympani nerve, which attends it for a short distance, then leaves it to pass on to the sub-maxillary ganglion. Filaments are given off from it to the

Internal pterygoid muscle,
Tonsils, soft palate, gums, and pharynx,
Sub-maxillary gland,
Hypoglossal nerve,
Sub-lingual gland,
and terminating filaments to the substance and papillæ of tongue.

2. The *temporo-auricular* or *superficial temporal*, passes outwards between the condyle of the lower jaw and external auditory meatus. It runs within the parotid gland, and in that situation divides into two branches, superior and inferior. The superior one passes upwards with the temporal artery, to the side of the head, communicating with the portio dura, and giving a filament to the articulation of the lower jaw and meatus externus. The other branch passes backwards behind the ear, giving filaments to it, and uniting with filaments from the cervical nerves.

3. The *inferior dental* nerve passes first between the pterygoid muscles, then between the internal pterygoid and ramus of the lower jaw, and enters the dental canal; reaching the foramen mentale, it divides into two branches—one runs forward to the symphysis, uniting with the opposite nerve, and supplying the canine and incisor teeth—the other passing out, called mental nerve, is distributed to the soft parts about the chin and lower lip.

In its course it receives a large short branch from the gustatory; and just before entering the dental foramen it gives off the mylo-hyoidean branch, to the mylo-hyoid muscle, the sub-maxillary gland, and digastric muscle.

In the dental canal it distributes twigs to the molar and bicuspid teeth.

The *sixth pair*, or *abducentes*, arise from the junction of the pons varolii with the corpora pyramidalia; they then pass through the dura mater; and traverse the inner part of the cavernous sinus, and on the outside of the carotid artery give filaments to communicate with the sympathetic; they then pass through the sphenoidal fissure, run between the two heads of the external rectus, divide into filaments, and are distributed to the external rectus, or abductor muscle of the eye.

The *seventh pair* consists of two portions, the *portio dura* and *portio mollis*.

The *portio dura*, or *facial nerve*, arises from a fissure between the corpora olivaria and restiformia, near the posterior edge of the pons varolii; it passes along the meatus auditorius internus in a groove of the portio mollis, and here unites with it slightly, then enters the canal of Fallopius, where it unites with the petrous branch of the vidian nerve, and forms an enlargement named *intumescentia gangliaformis*, which receives some other nervous filaments, named *external large* and *small petrosal*; in its course it gives a filament to the tensor tympani, and to the stapedius muscle, and is now considered by many anatomists to give off the *chorda tympani* nerve.

It next emerges at the foramen stylo-mastoideum, and, before its ultimate division, gives off three small branches:

1. The *posterior auricular* to the occipital muscle, the retrahens aurem, and external meatus.
2. The *stylo-hyoid* to the stylo-hyoid and digastric muscles.
3. The *digastric* branch to the posterior belly of the digastric muscle.

These three filaments all communicate with the neighbouring nerves.

The portio dura then enters the parotid gland, and divides into two, three, or more branches, named temporo-facial, and cervico-facial, which, by communicating filaments, form the pes anserinus; from this, three sets of branches pass off:

1. The temporal branches pass up over the zygoma, ramifying on the head and ear, and anastomosing with the occipital and frontal nerves.
2. The malar branches anastomosing with the superior and inferior maxillary nerves, and supplying the muscles of the face.

3. Descending branches anastomosing with the inferior maxillary on the lips and chin, and with the cervical nerves in the neck, supplying the platysma and integuments.

The filaments of the portio dura give the power of motion to the various muscles upon which they are distributed.

The *portio mollis* arises from the anterior part or floor of the fourth ventricle; it enters the meatus auditorius internus, in company with the portio dura, separated from it only by a small artery given off from the basilar; at the bottom of the canal it divides into minute filaments, which form two fasciculi; the anterior go to the cochlea, the posterior to the vestibule and semicircular canals.

The *eighth pair* consists of three nerves:

1st. The *glosso-pharyngeus* arises from the side of the medulla oblongata, in the groove between the corpus olivare and restiforme, and between the portio dura and nervus vagus; it passes forwards and out of the cranium, by the foramen lacerum posterius, anterior to the jugular vein; it descends perpendicularly almost in front of the carotid artery, passing between the stylo-pharyngeus and stylo-glossus muscles, towards the root of the tongue; as it escapes from the cranium, it forms a ganglionic enlargement, called the ganglion of Andersch.

The branches given off from it have been minutely traced by Arnold (*vide* Icones Nervorum Capitis), and are the following:

The tympanic branch from the ganglion, gives a filament to the carotid plexus, to the vidian in the hiatus Fallopii, and one to the otic ganglion. It is sometimes called Jacobson's nerve.

A branch to anastomose with the portio dura.

A branch to the nervus vagus and accessorius.

Branches to the stylo-hyoid and digastric muscle.

Pharyngeal branches to the pharyngeal plexus.

Tonsillary branches.

Terminal branches to the mucous membrane and follicles at the root of the tongue.

2d. The *nervus vagus, par vagum*, or pneumo-gastric nerve, arises just below the glosso-pharyngeus in the same fissure; it forms a flattened band, and passes out of the cranium by the foramen lacerum posterius, invested by a prolongation of dura mater; just before its exit it presents a small ganglionic enlargement, named *ganglion superius* or *jugular ganglion*, and at its exit it has a large, gangliform enlargement, named *ganglion inferius*, and communicates with the lingual, the glosso-pharyngeal, and sympathetic nerves; it next lies upon the rectus capitis anticus major, descends in the neck enclosed in the carotid sheath between the carotid artery and jugular vein; enters the thorax between the subclavian artery and vein, on the right side, giving off the right recurrent branch, which curves round the subclavian artery, and runs along the side of the trachea to the larynx; on the left side it enters the chest parallel with the left subclavian artery, and sends off a recurrent branch, which winds round the arch of the aorta, to be distributed like the recurrent of the right side; it then gives filaments to the bronchi, and passes downwards and backwards to the œsophagus, to which it supplies numerous filaments, which interlace freely together, forming the œsophageal plexus; these reunite and form a trunk on each side of the œsophagus, that on the right side being behind, that on the left being in front, and passing through the diaphragm, is finally distributed upon the stomach.

The particular branches of the par vagum are the following:

1. The *pharyngeal* branch, which, with filaments of the sympathetic laryngeal and glosso-pharyngeal nerves, forms the pharyngeal plexus upon the middle constrictor.

2. The *superior laryngeal* nerve, which descends on the inside of the carotid artery, and divides into two branches; the external one distributed to the crico-thyroid muscle and the thyroid gland; the other internal perforating the thyro-hyoid ligament is distributed to the epiglottis and its glands, the membrane lining the larynx, and anastomoses with the inferior thyroid.

3. *Cardiac* branches, to anastomose with the superficialis cordis.

4. The *recurrent* or *inferior laryngeal* passes along the side of the trachea, and reaching the larynx is distributed to all the proper laryngeal muscles, except the crico-thyroid; in its course it gives filaments to the pulmonary plexus, to the œsophagus and under surface of the trachea, to the inferior constrictor of the pharynx, and anastomoses with the superior laryngeal nerve.

5. *Bronchial* branches, forming, with the recurrent and sympathetic, the anterior and posterior pulmonary plexus.

6. *Œsophageal* branches, forming a plexus around the œsophagus.

The terminating branches ramify on the stomach, anastomosing with the hepatic, coronary, and solar plexus.

During the last few years the majority of physiologists consider that the superior laryngeal nerve presides over sensation only, and the inferior laryngeal presides over the motion of the muscles of the larynx, and is consequently the true nerve of voice.

3d. The *nervus accessorius*, or superior posterior respiratory nerve, takes its origin in the cervical portion of the spinal cord, as low as the fourth or fifth cervical vertebra; it then passes into the cranium, through the foramen magnum, and quits it by the jugular foramen; passing behind the internal jugular vein, it descends in the neck, perforating the sterno-mastoid muscle, to which it gives filaments, and is ultimately distributed to the trapezius muscle.

The *ninth*, hypoglossal, or lingual, arises from between the corpora pyramidalia and corpora olivaria; the fibres unite into a trunk on each side, which passes out at the anterior condyloid foramen, internal to the par vagum and sympathetic; it passes forward between the internal carotid artery and internal jugular vein, and descends and runs parallel with the lower margin of the digastric muscle; as it turns forward it hooks round the occipital artery, and here gives off its descendens noni branch, then runs above the os hyoides on the outer surface of the hyo-glossus muscle, and is ultimately distributed to the genio-hyo-glossus and lingualis muscles. The branches from it are the following:

Filaments to connect it with the glosso-pharyngeal, nervus vagus, accessorius, sympathetic, and nervous loop of the atlas.

The *descendens noni* branch, which runs down upon the carotid sheath, and anastomosing with filaments of the cervical nerves, forms an arch convex downwards, from which filaments are distributed to the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles.

Filaments to the stylo-pharyngeus, constrictors of the pharynx and crico-thyroid muscle.

Filaments to surrounding muscles.

Filaments to communicate with gustatory and terminal filaments to the lingualis and genio-hyo-glossus muscles.

Of the nine cranial nerves, some give special sensation, others ordinary sensation, and a third set motion to the parts they supply.

The first, or olfactory, is the nerve of the special sense of smell.

The second, optic, is the nerve of the special sense of sight.

The third, fourth, and sixth nerves are motor, supplying the muscles of the eyeball.

The fifth has a sensitive division, supplying the principal part of the face, and a motor division supplying the muscles of mastication.

The portio mollis of the seventh nerve supplies the special sense of hearing, whilst the portio dura supplies all the muscles of the face with motion, excepting the muscles of mastication.

The functions of the eighth pair are very various. The glosso-pharyngeal nerve is considered by many authorities to be a nerve of taste. Some, however, consider that function to be fulfilled by the gustatory branch of the fifth alone. It would seem to be more probable that both contribute to that function, inasmuch as injury to either nerve has been followed by more or less injury to the sense. It is the opinion of many physiologists that the gustatory is the nerve of ordinary sensation to the tongue, and that the glosso-pharyngeal is the nerve of bitter taste.

The pneumogastric nerve has different functions, according to the parts to which it is distributed. It may be said to preside over deglutition, the functions of the larynx, including voice, the functions of the lungs, and, in a great measure, the functions of the stomach.

The spinal accessory appears to be only a motor nerve.

The ninth cerebral nerve, called the hypoglossal, is the motor nerve of the tongue. Its function is undisputed.

The *spinal nerves* consist of thirty-one pairs; eight cervical, including the suboccipital, twelve dorsal, five lumbar, and six sacral nerves.

They arise by two fasciculi: those from the front give the power of motion; those from behind give sensation: they pass through the dura mater, then unite and perforate the lateral foramina of the vertebral canal, dividing into an anterior and posterior series. The anterior are generally the largest. A ganglion is formed on the posterior fasciculus, within the dura mater, before the union, and before the dura mater entirely quits the nerve.

CERVICAL NERVES.

The first *cervical*, or *suboccipital*, the smallest of the series, passes out of the spinal canal between the occipital bone and arch of the atlas; it then appears in the triangular space bounded by the rectus capitis posticus and oblique muscles, and divides into an anterior and posterior branch. The *posterior* one gives filaments to the small adjacent muscles and complexus, and a descending filament to the next nerve. The *anterior* branch runs forwards to the anterior surface of the spinal column, where it gives off the following filaments:

One to the second cervical nerve, descending before the atlas, and forming the *nervous loop of the atlas*.
" nervus vagus.
" Lingual nerve and first cervical ganglion.

The next three cervical nerves, uniting together by anterior descending branches, are described as forming the cervical plexus. Their posterior branches may be described as given off separately.

The second cervical nerve emerges between the atlas and vert. dentata. The posterior branch named *great occipital nerve*, larger than the anterior, runs upwards and backwards towards the occiput, and perforates the complexus muscle; after which it ascends with the occipital artery, and is distributed over the scalp, communicating with the frontal branches of the ophthalmic, ascending branches of the pes anserinus, and auricular branch of the third cervical nerve. In its course it gives filaments to the—

First and third cervical nerves; posterior recti, and oblique muscles; splenius, and complexus.

The third cervical nerve emerges between the vert. dentata and third cervical vertebra.

Its *posterior* branch, smaller than that of the second, winds backwards, perforates the muscles to become subcutaneous, and is distributed to the back of the head and neck. It gives off filaments to the second and fourth cervical nerves, and the various contiguous muscles.

The fourth cervical nerve emerges, like the former, from between the third and fourth cervical vertebræ. Its *posterior* branch is very small; it runs between the transverse processes of the corresponding vertebræ, gives filaments to the complexus splenius and trapezius, perforates the two latter muscles, and terminates in the integuments of the neck.

The anterior branches of the second, third, and fourth cervical nerves unite by filaments, soon after their exit; they communicate by filaments with the superior cervical ganglion, sometimes with the middle ganglion. They form the *cervical plexus*. This plexus rests upon the splenius colli, the anterior border of the scalenus posticus and levator anguli scapulæ, and is covered over by the sterno-mastoid muscle; the branches given off from it may be divided into superficial and deep. Most of the former are seen winding round the posterior edge of the sterno-mastoid muscle, to reach its external surface; and some descending as far as the clavicle.

The *superficial* branches are the following:

1. *Posterior*, or *small occipital*, ascends along the posterior edge of the sterno-mastoid muscle to the occiput, giving filaments to the back of the ear and occipital integuments. It anastomoses with the nervus accessorius and portio dura.
2. *Middle*, or *great auricular nerve*, first crosses the sterno-mastoid muscle, a short distance above the external jugular vein, ascends towards the parotid gland, where it divides into filaments; some enter the gland and unite with the portio dura, others mount up in front of the ear, others ascend behind it, and are distributed to the integuments, of the head.
3. The *anterior branch*, *transverse cervical* or *superficialis colli*, ascends and inclines towards the submaxillary gland, supplying filaments to the digastric muscle and platysma myoides, and to the submaxillary ganglion, or plexus; thus communicating with the lingual and chorda tympani.
4. The *descending filaments* pass between the trapezius and sterno-mastoid muscle, and are distributed to the integuments about the clavicle, acromion, the omo-hyoid, and serratus magnus muscle. They may be named *supra-clavicular*, *supra-acromial*, and *subclavicular*.

The deep branches of the cervical plexus are the following:

Some, to communicate with the nervus accessorius, and to supply the trapezius and levator anguli scapulæ.

Branches to unite with the descendens noni, forming an inverted arch, from which filaments, as before described, pass off.

The *phrenic*, chiefly derived from the third and fourth, receives also a filament from the fifth cervical nerve. It descends in the neck, upon the anterior scalenus muscle; enters the chest, between the subclavian artery and vein, communicating here with the nervus vagus, or recurrent nerve, and inferior cervical ganglion; it then passes anterior to the root of the lungs, runs between the pleura and pericardium, which it grooves, and arrives at the diaphragm, to the muscular fibres of which it is principally distributed; on the right side it sends filaments, through the opening of the vena cava, to the surface of the liver; others, penetrating the diaphragm, and reaching its under surface, accompany the branches of the phrenic artery, to reach the solar plexus.

The left phrenic nerve is longer than the right, having to wind round the apex of the heart.

The fifth, sixth, seventh, and eighth cervical nerves, with the first dorsal, by their anterior branches, and filaments from the sympathetic, form the *brachial plexus.* The posterior branches of the four inferior cervical nerves are very small, and are distributed to the deep-seated muscles and integuments of the immediately surrounding parts.

The nerves about to form the *brachial plexus* pass out from between the scaleni muscles, and then combine to form this plexus. The fifth and sixth form together a single trunk, as also the eighth cervical and first dorsal, whilst the seventh cervical runs some distance before joining the plexus.

The plexus passes downwards and outwards beneath the subclavus muscle, and over the first rib; and in the axilla, opposite the coracoid process, divides into its terminal branches.

Its branches consist of those distributed to parts above the arm, and those which go to the arm entirely; of the latter there are six, namely, the external and internal cutaneous, the circumflex, ulnar, median, and musculo-spiral, or radial; of these, three only reach the fingers, namely, the ulnar, median, and musculo-spiral. The first series from the plexus includes the suprascapular, subscapular, and thoracic nerves.

The *suprascapular nerve,* given off from the plexus, high up, passes outwards and backwards towards the superior margin of the scapula, accompanying the artery of the same name. It runs through the suprascapular notch, where it gives off a branch to the supra-spinatus muscle, and passing beneath the acromion process, is distributed to the infra-spinatus and teres minor muscles.

The *subscapular* branches are generally three; they run down in the course of the subscapular artery, supplying filaments to the subscapularis muscle, teres major, and latissimus dorsi.

The *thoracic* nerves are three or four in number; two of these run down in front of the axillary vessels, to reach the pectoralis major and minor, upon which they are distributed; the other, named posterior thoracic, descends behind the axillary vessels to the inside of the axilla, distributing filaments to the serratus magnus muscle. It is the posterior inferior respiratory nerve of Sir C. Bell. This nerve is described by many as coming off from the cervical plexus, at about the same point as the phrenic nerve, but posterior to it.

NERVES OF THE ARM.

The *internal cutaneous* nerve is the smallest of the brachial branches of the plexus; it descends along the inside of the arm, under the fascia, and divides, near the elbow, into two branches, which perforates the fascia, and then run quite superficially. Before the division it gives off filaments which perforate the fascia, and are distributed to the integuments covering the triceps and biceps. The terminal branches are the following:

The *anterior* branch passes over the median basilic vein, and descends as far as the wrist, in its course giving filaments to the integuments; some to communicate with the external cutaneous, and some to join with the other branch of the same nerve.

The *internal* branch inclines quite to the inner side of the forearm, and runs down to the wrist; in its course it gives filaments to the integuments, some to unite with the other branch, and terminating filaments to the inner border of the hand.

The *external cutaneous* nerve, also named *musculo-cutaneous* and *perforans Casserii*, larger than the former, proceeds from the upper and external portion of the plexus; descends, and generally perforates the coraco-brachialis muscle; then runs downwards and outwards under the biceps and upon the brachialis anticus muscle; then between the biceps and supinator radii longus; it then perforates the fascia and becomes superficial, runs between the median cephalic vein and fascia, and descends as far as the wrist, where it terminates. Its branches are the following:

Muscular filaments to the coraco brachialis, biceps, and brachialis anticus.

Filaments to the integument, communicating with those of the internal cutaneous and musculo-spiral.

Terminating filaments to the root of the thumb and the wrist, communicating with cutaneous filaments of the median.

The *circumflex* nerve proceeds from the posterior part of the plexus, backwards and outwards, beneath the inferior edge of the subscapularis muscle, accompanies the posterior circumflex artery behind the humerus, and winds round it, to reach its anterior-external surface, where it is finally distributed to the deltoid muscle. It also gives filaments to the teres minor, cutaneous filaments over the deltoid and upper part of the triceps, and a branch to the shoulder-joint.

The *ulnar* nerve arises from the inner side of the plexus, descends along the inner side of the arm, supported by the short head of the triceps, as far as the space between the inner condyle and the olecranon; here it passes between the two origins of the flexor carpi ulnaris, and along the forearm, rests upon the flexor digit. profundus, to the ulnar side of the artery, overlapped by the flexor carpi ulnaris; lower down it runs distinctly along the radial edge of the flexor ulnaris; when arrived at the wrist it passes over the annular ligament with the ulnar artery, and in the hand divides into two terminating branches, the superficial and deep. The filaments given off by it are the following:

One or two to teres major and latissimus dorsi.

„ to the long and short head of triceps.

In the fore-arm filaments to the adjacent flexor muscles, communicating with the median.

A branch quits it, about the upper part of the lower third of the forearm, runs under the flexor carpi ulnaris, and arrives at the surface of the extensor ulnaris to reach the little finger. It gives a filament to the abductor minimi digiti, and another which bifurcates to supply the opposed sides of the ring- and little finger, and communicates with the digital filaments of the musculo-spiral.

The *superficial* branch of the hand goes to supply the little finger and half the ring-finger; one branch of it runs along the muscles of the little finger, giving them filaments, and courses along the ulnar side of this finger, as far as the tip; the other filament runs along the surface of the adductor minimi digiti, and having united with a filament from the median, on arriving at the head of the fourth and fifth metacarpal bones, bifurcates to supply the opposed sides of the ring and little fingers.

The *deep-seated* palmer branch, forming the deep arch of nerves, sinks deep in the hand, passing beneath the adductor minimi digiti, and running upon the interossei muscles, beneath the flexor tendons, and terminating by filaments to the adductor pollicis. It gives filaments to the small muscles of the fingers, and to the interossei muscles.

The ulnar nerve also gives off several small articular filaments, to the elbow and wrist-joints.

The *median nerve* takes its origin from the brachial plexus, by two roots which embrace the axillary artery; they soon unite, to form a single nerve, which descends about half way down the arm, on the outer side of the brachial artery; after which it inclines over the artery, then gets to its inner side, gradually diverging from it, so that at the bend of the elbow there is a distinct space between them; in this course it rests upon the coraco brachialis and brachialis anticus, internal to the biceps muscle; it then passes between the two origins of the pronator teres, and descends between the flexor sublimis and profundus, passes under the annular ligament at the wrist, and terminates in the hand by its digital branches. The branches and filaments given off by it are the following:

A few *muscular* twigs in the arm, to the muscles which arise from the inner condyle.

The *anterior interosseous* nerve, which accompanies the corresponding artery, runs between the flexor profundus and flexor pollicis longus, as far as the pronator radii quadratus; it runs beneath this, and perforates the interosseous ligament, to arrive at the dorsal surface of the hand, to which it distributes filaments.

A small branch near the wrist passes over the annular ligament to the skin of the palm of the hand.

The terminal digital branches are five; and, with a branch from the ulnar, form the superficial palmar arch of nerves.

The first goes along the outside of the thumb, to its extremity, giving filaments to the abductor and flexor brevis.

The second runs along the inside of the thumb.

The third gives filaments to the abductor indicis and first lumbricalis, and runs along the outside of the index finger.

The fourth takes the course of the second metacarpal space, gives a filament to the second lumbricalis, and bifurcates to supply the opposed sides of the index and middle fingers.

The fifth lies in the next metacarpal space, supplies the third lumbricalis, and bifurcates to supply the opposed sides of the middle and ring fingers; this branch communicates with the ulnar nerve, as before mentioned.

The *musculo-spiral* or *radial* nerve, one of the largest branches of the brachial plexus, emerging from its centre and posterior part, soon after its origin inclines downwards, outwards, and backwards, winds round the humerus, accompanied by the superior profunda artery; it next appears between the supinator longus and brachialis anticus, between which it runs as far as the elbow, where it divides into an anterior or external and a deep-seated branch.

The *anterior* or *radial* branch descends with the supinator longus muscle, and, at about the middle third of the forearm, arrives at the outer side of the radial artery, which it accompanies for about two or three inches; it then leaves it, passing under the supinator muscle, running superficially to the extensor muscles of the thumb, and just above the wrist, dividing into terminal branches which reach the back of the hand. The filaments from it are—

Several *muscular* filaments to the supinator and extensor muscles.

Terminal filaments, generally three in number; one to the radial side of the thumb.

One bifurcates to supply the ulnar side of the thumb and the radial side of the index finger.

The third bifurcates to supply the opposed sides of the index and middle fingers, and occasionally a fourth supplies the opposed sides of the middle and ring-fingers.

The *deep-seated* branch, or *posterior interrosseous*, larger than the other, passes backwards and downwards beneath the supinator longus and two radial extensors, then perforates the supinator brevis, and divides into several filaments, which supply all the muscles on the back of the forearm, except the anconeus, supinator radii longus, and extensor carpi radialis longior. It passes down to the back of the wrist, where it forms a gangliform enlargement, and gives some minute twigs to the ligaments and articulations of the carpus.

Some to the extensors of the thumb and fingers.

The filaments of the musculo-spiral given off before its division, are the following:

Two or three to the triceps: one of these arrives at the skin, and has been named *superior external cutaneous* nerve; it descends upon the forearm, and communicates with the external cutaneous nerve. It also gives filaments to the brachialis anticus, anconeus, supinator radii longus, and extensor carpi radialis longior.

In addition to the nerves above described as coming from the brachial plexus, the inside of the arm is supplied with branches given off from the second and third intercostal, and have been named the cutaneous nerves of Wrisberg; but which occasionally proceed from the brachial plexus.

DORSAL NERVES.

The dorsal or intercostal nerves are twelve on each side. They emerge from the intervertebral foramina; the first between the first and second dorsal, the last between the last dorsal and first lumbar vertebra. Immediately after their exit they divide, like the cervical, into anterior and posterior branches; the posterior branches run backwards between the transverse processes of the vertebræ to supply the deep muscles of the back and the integuments.

The *anterior* branches, named also intercostal, run along the intercostal spaces, below the vein and artery, and near the margin of each rib, between the external and intercostal muscles; about midway between the spine and sternum they give off a large superficial branch. The continued portion of the seven superior nerves is distributed to the intercostal muscles and triangularis sterni, and then perforates these, to be lost finally in the pectoralis major and integuments.

The next four intercostal nerves, corresponding with the four superior false ribs, on reaching the ends of the cartilages, pass forwards between the internal oblique and transversalis muscles, to reach the rectus abdominis, supplying filaments to all these muscles.

The filaments from these several dorsal nerves are as follows:

From each a filament or two of communication to the contiguous ganglion of the sympathetic.

The first dorsal nerve is large, and enters almost entirely into the formation of the brachial plexus.

The superficial branches of the second, third, and occasionally the fourth, after perforating the external intercostal muscles, cross the axilla, descend to the inside of the arm, as low down as the inner condyle, communicating with the internal and cutaneous nerve. They are by some named *intercosto-humeral* nerves, or nerves of Wrisberg.

The superficial branches of the seven succeeding intercostal nerves are distributed to the mammæ, pectoralis major, external oblique muscle, and integuments, according to their situations.

The twelfth dorsal differs from all the others; it first sends a large branch to the first lumbar nerve, then passes forwards and a little downwards upon the quadratus lumborum, at the edge of which it divides into two filaments; the deep one passes forwards to the space between the transversalis and internal oblique muscle, to reach the rectus, supplying filaments to each; the superficial filament runs between the internal and external oblique muscles, supplying them and the integuments.

LUMBAR NERVES.

The lumbar nerves are five in number, and have a double origin like the dorsal nerves. They form part of the cauda equina. They pass out of the canal at the inter-vertebral foramina, and, soon after their exit, divide into anterior and posterior branches; the first emerges between the first and second lumbar vertebræ, the fifth between the last lumbar vertebra and the sacrum.

The *posterior* branches take a course backwards, between the corresponding transverse processes of the vertebræ, and supply the deep lumbar muscles.

The *anterior* branches pass downwards and somewhat outwards, are connected together by twigs, and, with the filaments of the sympathetic, form an interlacement, named lumbar plexus. These nerves increase in size from above downwards.

The *lumbar plexus* is formed in the substance of the psoas muscle, by the four superior lumbar nerves, and receives branches from the last dorsal and the sympathetic ganglia, along the sides of the bodies of the lumbar vertebræ.

The branches given off by the plexus are—

Musculo-cutaneous; external cutaneous, external pudic; crural; obturator, and a communicating branch to the sacral plexus.

The musculo-cutaneous branches, two in number, chiefly from the first lumbar nerve, pass through the psoas muscle, forwards upon the anterior surface of the quadratus lumborum, to reach the crista ilii. These branches are named by many anatomists *ilio hypogastric* and *ilio inguinal.*

The ilio-hypogastric branch (also known as *superior* musculo-cutaneous, after perforating the psoas muscle and reaching the crest of the ilium, divides into two branches, iliac and hypogastric. The *iliac* branch pierces the internal and external oblique muscles, and is distributed to the skin of the gluteal region. The *hypogastric* branch pierces the oblique muscles and runs forwards to supply the integument in the hypogastric region.

The ilio-inguinal branch (also called *inferior musculo-cutaneous*), after piercing the psoas magnus and crossing the quadratus lumborum and iliacus, perforates the transversalis, runs between it and the internal oblique to which it gives filaments, to the crest of the ilium, then perforates the internal oblique, and then accompanies the spermatic cord and passes out at the external abdominal ring and supplies the integument of the scrotum and upper and inner part of the thigh of the male and labia of the female.

The *external cutaneous nerve,* arising chiefly from the second lumbar, passes downwards and forwards, upon the iliac fascia, towards the anterior superior spinous process of the ilium, below which it passes and gets out of the pelvis; it pierces the fascia lata, and is distributed by two filaments; one passing downwards and sub-cutaneous to the outer part of the thigh, the other running down as far as the outside of the knee.

The *external pudic nerve,* also named *genito-crural* or *external spermatic,* appears to come off chiefly from the second lumbar nerve; it pierces the psoas muscle, and descends upon its anterior surface, and at the crural arch divides into two branches, named internal and external.

The *internal* branch accompanies the spermatic cord of the male, or round ligament of the female; and is distributed to the cremaster and coverings of the testicle and adjacent parts of the groin; or to the pubes and labia of the female.

The *external* branch passes under Poupart's ligament, perforates the fascia lata, and is distributed to the glands and parts in front of the thigh.

The *crural nerve* appears to be derived from the second, third, and fourth lumbar nerves. It is at first placed between the psoas and iliacus muscles, descends under the fascia iliaca, and then passes under the crural arch on the outside of the psoas muscle, which separates it from the femoral artery. In this course it gives twigs to the iliacus and psoas muscles. After passing Poupart's ligament it divides into several branches, superficial and deep. The superficial branches soon pierce the fascia lata, and extend as far as the front and inner side of the knee. The deep branches may be divided into—

External; internal; descending.

The *external* branches pass in front of the iliacus and psoas, supplying filaments to the sartorius, rectus, tensor vaginæ femoris, two vasti and cruræus muscles.

The *internal* branches pass beneath the femoral vessels to supply the pectineus and adductor longus.

The *descending* branches accompany the femoral artery; one, *shorter*, runs on its outer side, giving filaments to the sartorius, and is lost in the vastus internus, near the knee. The *longer* branch runs upon or within the sheath of the artery, and passes under the fascia, which extends from the adductors to the vastus internus; it quits the artery at the opening of the great adductor, and runs along the inside to the knee, and then accompanies the internal saphena vein, as far as the dorsum of the foot, where it terminates, by sending filaments to the inner side of the foot and great toe. This branch is named *nervus saphenus internus*.

The *obturator nerve* seems to arise from the third and fourth lumbar, passes along the inner edge of the psoas, between the peritoneum and pelvic fascia, to reach the obturator foramen, which it passes through, and then gives off branches

To the *external obturator muscle.*
A filament to the hip-joint.
A deep posterior branch to the adductor magnus, and a deep branch passes down with the popliteal artery, and, perforating the posterior ligament, supplies the synovial membrane of the knee-joint.
An anterior branch to the gracilis, and long and short adductors, and inside of the knee.

The *lumbo-sacral nerve* is the last given off from the lumbar plexus. It is formed from the anterior branch of the fifth and a twig from the fourth; it passes down to the pelvis, and unites with the first sacral, so as to contribute to form the sacral plexus.

The only nerve given off from it is the superior *gluteal nerve,* which passes out by the sacro-sciatic notch, with the gluteal artery, and is distributed to the gluteal muscles and tensor vaginæ femoris.

The *sacral nerves* are six on each side, each consisting of an anterior and posterior branch; they arise from the cauda equina, and emerge from the sacral foramina.

The four *superior posterior* branches pass out at the posterior sacral foramina, perforate the tendon of the sacro-lumbalis and become superficial, and are distributed to the skin covering the nates.

The inferior *posterior* branches run downwards to supply the integuments about the anus.

The *anterior* branches pass out at the sacral foramina, decreasing in size as they come out, from above downwards. They all communicate with the sacral ganglia of the sympathetic. The three superior nerves with descending branches from the fourth and fifth lumbar nerves, and a branch from the fourth sacral, form the *sacral plexus*.

The fourth nerve gives filaments to the hypogastric plexus, levator ani, coccygeus, the skin above the anus, and sphincter ani.

The fifth and sixth sacral nerves are very small, and are lost in the coccygeus and sphincter ani.

The *sacral plexus*, formed as above mentioned, rests upon the pyriformis muscle, and gives off internal and external branches. The internal branches are—

Hæmorrhoidal; vaginal; uterine; vesical; pudic.

The external branches are—

Great sciatic; small sciatic.

The *hæmorrhoidal branches* pass to the muscular and mucous coat of the rectum, and communicate with the neighbouring nerves.

The *vaginal* and *uterine* branches ramify as their names imply.

The *vesical* branches pass to the lower part of the bladder, and supply its muscular and mucous coat, the prostate gland, and vesiculæ seminales; and in the female, the urethra.

The *pudic* nerve is the largest of the internal branches, and appears to come chiefly from the third sacral. It follows very closely the course of the pudic artery; the branches given off by it are—

A *superficial perineal* branch, which gives off long twigs to the sphincter ani and margin of the anus, and filaments to the erector penis, accelerator urinæ, and transversus perinæi, and is lost upon the dartos and scrotum.

Branches to the obturator internus.

„ integuments, urethra, and glans penis.

The superficial perineal branch is largest in the female, and is distributed chiefly upon the labia.

The *small sciatic nerve* gets out from the pelvis below the margin of the pyriformis muscle, to the inner side of the great sciatic nerve, supported by the superior gemellus, and overlapped by the gluteus maximus. Its branches are—

Inferior gluteal, consisting of small filaments to the gluteus maximus.

Posterior and *internal cutaneous*, which passes inwards, beneath the tuber ischii, gives filaments to the gracilis, and, perforating the fascia, is distributed to the integuments about the inside of the thigh, scrotum, or labia.

Middle cutaneous pierces the fascia, and descends, supplying the skin, as far as the popliteal space.

The rest of the nerve descends and gives filaments to the flexor muscles, as far as the inside of the ham.

The *great sciatic nerve* is the largest nerve of the body. It passes out of the pelvis below the pyriformis muscle, then descends between the great trochanter and tuber ischii, over the small rotators, viz., the gemelli, obturator internus, and quadratus femoris, then rests upon the abductor magnus, under cover of the flexors of the thigh, and descends towards the popliteal space.

There are small branches given off by it—

to the internal obturator muscle, and to the lesser sciatic nerve.
filaments to the gluteus maximus.
„ flexor muscles.
superficial branches which pierce the fascia, and are distributed to the outside of the knee, forming external cutaneous branches.
filaments to the external rotators.
„ hip-joint.
„ adductor magnus, and
„ short head of the biceps.

The great sciatic nerve divides about midway down the thigh into two branches, the *tibial* and *peroneal*, the former being named *popliteal* till it reaches the leg, and appears to be the proper continuation of the sciatic nerve.

The popliteal nerve passes down in the popliteal space, under the fascia, but superficially to the artery and vein; after passing the joint it rests on the popliteus muscle, under cover of the gastrocnemius, then crosses to the posterior tibial artery, and descends on its outer side, and is here properly named posterior tibial nerve; it then passes down with the artery, and in the sole of the foot divides into external and internal plantar nerves.

The branches given off by this nerve are—

Muscular twigs in its course.

A long branch given off in the popliteal space (named *communicans tibiæ*, or *communicans poplitei*) descends between the two heads of the gastrocnemius, then over its posterior surface, running downwards to the outer border of the tendo Achillis; it accompanies the saphena minor vein, and about the middle of the leg unites with a similar branch sent off from the peroneal nerve. This external *saphenous* nerve passes behind the outer ankle to the dorsum of the foot, where it divides into filaments, which extend to the fourth and fifth digital phalanges. In its course down the leg it gives filaments which pierce the fascia and become subcutaneous.

The posterior tibial nerve in its course down the leg supplies filaments to the muscles in its immediate proximity, viz., the plantaris, gastrocnemius, soleus, tibialis posticus, and long flexors of the leg, and lower down gives filaments to the ligaments of the ankle, bursa and fascia about the tendo Achillis.

In the hollow of the foot this nerve gives off a filament to the integuments of the sole, and then divides into external and internal plantar nerves.

The *internal plantar nerve*, the larger of the two, takes the course of the internal plantar artery, gives branches to the abductor pollicis, flexor brevis digitorum, and accessorius, and divides into four filaments, very like the median in the hand; one branch, the smallest, passes to the inside of the great toe, the three others bifurcate to supply the opposed sides of the first, second, third, and fourth toes, giving filaments to the lumbricales and interossei muscles; the fourth nerve gives off a filament to communicate with the superficial branch of the external plantar nerve.

The *external plantar* nerve runs forwards between the flexor brevis and accessorius, in its course giving a branch to the abductor minimi digiti; it then divides into a superficial and deep branch. The *superficial* branch gives off a filament to the outside of the little toe, and then runs in the space between the fourth and fifth toe, giving a communicating filament to the fourth terminating branch of the internal plantar nerve, and afterwards separates into two filaments to supply the opposed sides of the fourth and fifth toes.

The deep-seated branch runs close upon the metatarsal bones, supplying filaments to the interossei, flexor brevis pollicis, and transversalis pedis muscles.

The *peroneal* or *fibular* nerve, one of the branches of the great sciatic, in its course is inclined outwards, and descends between the biceps and outer head of the gastrocnemius, to reach the head of the fibula; a little below this it winds round the neck of the bone, and divides into two branches, the *anterior tibial*, or *interosseous* and the *musculo-cutaneous;* the latter, in its direction, appears to be the continuation of the nerve, and descends between the peronæus longus and extensor communis digitorum longus, giving branches to them in its course. About the middle of the leg it escapes from between the muscles and descends between the extensor muscles and fascia, and divides into two branches.

The *external* branch descends and passes in front of the outer ankle, reaches the dorsum of the foot, and gives off three filaments, one to supply the dorsum of the little toe and outside of the foot; another passes between the fourth and third toes, supplying both, and a third is distributed between the second and third toes.

The *internal* branch goes to supply the inner border of the foot, and gives filaments to the upper surface of the first and second toes.

The branches of the peroneal, in its course downwards, are, one in the popliteal space to the short head of biceps, terminating in the ligaments on the outside of the joint, a branch which descends between the gastrocnemius externus and fascia, and gives off filaments which ramify on the outside of the leg, and one named *communicans peronei*, which unites with the superficial branch of the posterior tibial nerve, to form the external saphenus nerve.

The *anterior tibial* or *interosseous nerve*, directly after its separation from the other branch of the peroneal, winds forwards and inwards between the fibula, the peroneus longus, and extensor communis, to which it gives filaments; it then arrives at the interosseous ligament, and accompanies the anterior tibial artery, lying to its outer side, but lower down, rather in front of it, in which position it passes under the annular ligament to the dorsum of the foot. In its descent it gives filaments to the adjacent muscles, and on the foot divides into two branches:

One supplying the extensor brevis and the interossei, and communicating with the peroneal nerve, and giving branches to the tarsal and metatarsal articulations.

The other passes to the first and second toes.

SYMPATHETIC NERVE.

The sympathetic nerve (or nerves, as there is a similar structure on each side of the body) was formerly called the great intercostal nerve, and was described as commencing in the cavernous sinus by filaments from the fifth and sixth cerebral nerves. It is now viewed as a separate nervous system, named *ganglionic*, and is described as consisting of a series of ganglia, or nervous centres, connected together by filaments, and communicating in various parts with filaments derived from the cerebro-spinal nerves. From its apparent functions it is called the nerve of organic life. The ganglia are found in five regions of the body; namely, the head, neck, chest, abdomen, and pelvis, and are named accordingly.

The *cranial* ganglia are the *ophthalmic*, *spheno-palatine*, *otic*, *ganglion of Cloquet*, *submaxillary*, *carotic*, and a disputed one upon the arteria communicans, named *ganglion of Ribes.*

The cervical ganglia are three;

The dorsal, twelve;

The lumbar, five;

The sacral, four or five on each side, with an azygos ganglion near the coccyx.

The *ganglion of Ribes* is situated upon the anterior communicating artery, receiving filaments from the carotic plexus. Its existence is disputed by many.

The *ophthalmic* or *lenticular* ganglion is situated within the orbit between the optic nerve and external rectus muscle, and midway between the entrance of the optic nerve and the sclerotic coat. It is small, and is imbedded in a large quantity of fat.

The filaments from it are—

Anteriorly, fifteen to twenty, named short ciliary; they pass forwards, perforate the sclerotic coat at its posterior part, run forward between the sclerotic coat and choroid, and part of them pass into the iris; the greater number are lost in the ciliary ligament.
Posteriorly, at the upper angle, a filament to the nasal nerve of the fifth;
at the inferior angle, a filament to the inferior division of the third cerebral nerve;
a third filament passes backwards to reach the carotic plexus.

The *spheno-palatine*, or *Meckel's* ganglion, is situated in the pterygo-maxillary fossa, having in front the tuberosity of the superior maxillary bone; behind, the roots of the pterygoid processes; internally, the palate bone and spheno-palatine foramen, and externally, the soft parts filling up the fossa. The branches of this ganglion are ascending, descending, internal, and posterior.

The *ascending*, or superior, are usually two, and very large; they unite with the superior maxillary nerve.

The *descending* are the palatine nerves, three in number. The *great palatine* nerve descends in the great palatine canal, and emerges at the posterior palatine foramen, from which it runs forward beneath the arch of the palate, as far as the foramen incisivum, where it communicates with Cloquet's ganglion. In its course it gives filaments, through the nasal plate of the palate bone, to the pituitary membrane of the nose, filaments to the velum palati, tonsil, and soft parts of the palate and gums.

The *middle palatine* descends parallel with the former, in a distinct canal, and is distributed to the soft palate and tonsil.

The *small palatine*, posterior to the two others, supplies the tonsil and soft palate.

The *internal*, or spheno-palatine, passes into the nasal fossæ, through the spheno-palatine foramen, by three or four filaments. They ramify upon the spongy bones, but one branch passes down upon the floor of the nose, runs through the anterior palatine foramen to the ductus incisivus, and communicates with Cloquet's ganglion. It is called the naso-palatine nerve, or nerve of Cotunnius.

The *posterior* branch is the *vidian*. It runs backwards through the vidian canal, and having reached the foramen lacerum medium, divides into two branches, the *carotic* and *petrous*. The carotic branch runs down to the carotid artery, uniting with the plexus of this artery, and is thus connected with the first cervical ganglion; the petrous branch perforates the cartilage, filling up the foramen lacerum, and then runs beneath the dura mater, towards the foramen innominatum, which it enters; soon after its entrance it unites with the portio dura, and runs with it along the aqueduct of Fallopius to its inferior extremity, where it leaves it; it then perforates the petrous bone and gets into the tympanum, running between the long crus of the incus and handle of the malleus, hence called *chorda tympani*, and emerges at the fissura glasseri; it then descends to the inner side of the lower jaw, communicating with the gustatory, and is ultimately distributed to the submaxillary ganglion.

N.B. The *chorda tympani* nerve is described by some as proceeding from the portio dura of the 7th.

Cloquet's ganglion, or naso-palatine, is situate in the anterior palatine canal, or foramen. It receives from each side superiorly, the naso-palatine nerve; inferiorly, a filament from the great palatine nerve; and sends two or three twigs to the mucous membrane, on the anterior surface of the hard palate.

The submaxillary ganglion, or plexus, is small, and has a plexiform appearance. It rests upon the submaxillary gland. It communicates with the following nerves:

Posteriorly, with the vidian.
Superiorly, with the gustatory.
Inferiorly, it gives off filaments to accompany the Whartonian duct.

The *otic* ganglion, first minutely described by Arnold, is seated at the base of the skull, very near to the foramen ovale, and to the inner side of the third division of the fifth pair; internal to it is the Eustachian tube, and circumflexus palati; posteriorly, the middle meningeal artery. It communicates, by small filaments, with—

the third division of the fifth pair, at its exit from the foramen ovale;
the pterygoid nerve;
the tympanic branch of the glosso-pharyngeal nerve, by a minute petrous twig.

It appears to give off—

a filament to the tensor tympani muscle;
to the tensor palati;
to the anterior auricular nerve.

The *superior cervical ganglion* extends from the foramen magnum to the second or third cervical vertebra, generally more than an inch in length; it is oblong in its figure, and of considerable size. The branches from it are the following:

Ascending,	to communicate with the carotic plexus in the carotic canal.
External,	to the cervical nerves.
Internal,	to the pharynx, entering into the pharyngeal plexus.
Anterior,	to unite with the par vagum, glosso-pharyngeal, lingual and facial nerves, and filaments named nervi molles, which accompany some of the branches of the external carotid; namely, the superior thyroid, lingual, labial, and ascending pharyngeal.
Descending,	to the second ganglion: and filaments to form the superficialis cordis.

The *middle cervical ganglion* is very small, and sometimes wanting on the left side. Its situation is upon the fifth cervical vertebra. It gives filaments to the superior and inferior ganglia, to the cervical nerves, the thyroid gland, superior thyroid artery, and parts adjacent, and sends off the middle cardiac nerve.

The *inferior cervical ganglion* lies upon the transverse process of the last cervical vertebra, and neck of the first rib, behind the vertebral artery. It gives off filaments to the middle cervical and superior thoracic ganglia, branches to unite with the axillary plexus, filaments to accompany the vertebral artery, which form the vertebral plexus, and which run up as far as the base of the skull, communicating in their course with all the cervical nerves: it gives also filaments to the pulmonary plexus, and sends off the inferior cardiac nerve.

The *cardiac* plexus, destined for the supply of the heart, is formed by the cardiac nerves of the cervical ganglia, and branches from the nervus vagus and recurrent nerves. It is placed around the aorta, the greater portion being somewhat above it, and between it and the trachea; the other portion just below the arch, and rather on its anterior aspect, resting somewhat upon the pulmonary artery. This portion has been named cardiac ganglion. The branches from this plexus are the following:

Some going to the pulmonary plexus.
Some to the anterior part of the aorta.

Many follow the course of the coronary arteries, and are called coronary plexuses; namely, right, or anterior, and left, or posterior. They follow the arteries, and send filaments into the substance of the heart.

The *thoracic* ganglia, twelve, sometimes only eleven in number, lie upon the heads of the ribs, and are connected together by one or two small filaments; they then give off branches to unite with the intercostal nerves. The superior five ganglia give off anterior filaments to the trachea, œsophagus, and aorta, and contribute to form the pulmonary cardiac, and thoracic plexuses. The anterior branches, from the sixth to the ninth, inclusive, unite to form the splanchnicus major; and similar branches from the tenth and eleventh ganglia form the splanchnicus minor. These nerves descend by the side of the vertebræ, pierce the crura of the diaphragm separately, and enter the abdomen. The splanchnicus major passes to the semilunar ganglion of each side, and the splanchnicus minor to the renal plexus.

The *semilunar* ganglion of each side is situated close to the cœliac axis, around which the fibres interlace, and, with filaments from the nervus vagus, phrenic, and splanchnicus minor, constitute the great *solar plexus*. From this branches pass off to accompany the contiguous arteries and are named so many plexuses. They are:

Phrenic, to the crura, and broad part of the diaphragm running with the arteries.

The *coronary*, or *stomachic*, accompany the coronary artery to the stomach, distributed upon both its surfaces.

The *hepatic* plexus, accompanying the vessels into the transverse fissures of the liver; some of its filaments pass to the pylorus, others along with the gastro-duodenal artery. This plexus unites with filaments from the nervus vagus.

The *splenic* plexus, accompanying the splenic artery, and sending filaments with the vasa brevia to the great end of the stomach.

The *aortic* plexus, a continuation, as it were, of the solar plexus upon the aorta, with branches from the lumbar ganglia, may be said to send off the *superior* and *inferior mesenteric plexuses*, to accompany the corresponding arteries.

The *splanchnicus minor*, with other filaments from the sympathetic, form the renal plexus, which sends numerous filaments into the kidney, with the arterial branches; and gives off inferiorly some filaments to accompany the spermatic artery, and which constitute the spermatic plexus.

In the abdomen we find the *lumbar* ganglia, four or five in number, by the sides of the lumbar vertebræ, and to the inner edge of the psoas muscle. They are connected together by filaments, and are connected with the lumbar nerves and plexus, and send filaments anteriorly to the aorta, which enter into the composition of the abdominal, aortic, and lumbar plexuses.

The *sacral ganglia* are four or five on each side, with an azygos terminating one; they unite together by filaments, and communicate with the contiguous spinal nerves. Anterior filaments from them, and also from the lowest lumbar ganglion, form the hypogastric plexus, which supplies nerves to the adjacent viscera, viz., the bladder, vesiculæ seminales, uterus, vagina, and rectum.

ANATOMY OF THE ORGANS OF THE SENSES.

THE EYE.

The eye is placed within a bony cavity named the orbit.

Each *orbit* is formed by seven bones; and as three of them are common to both orbits, there are eleven bones only entering into the two. The orbit is pyramidal in form, with the base anteriorly and directed a little outwards; the apex backwards and inwards. Probes passed through the axis of each orbit, into the cranium, will pass through the foramen lacerum orbitale superius, and meet upon the sella turcica. The roof of the orbit is formed by the frontal bone and ala minor of the sphenoid bone; the floor by the malar, superior maxillary, and palate bone; the outer wall by the malar and sphenoid; and the inner wall by the nasal process of the superior maxillary, the lachrymal, the ethmoid, and frontal bones.

The orbit contains the globe of the eye, with numerous muscles, nerves, vessels, fat, and part of the lachrymal apparatus.

In dissecting the orbit, and removing its roof, the nerves will be found entering in the following order:

Fourth pair.
Frontal of the fifth.

Superior division of the third.
External to these, and nearly on the same plane, the lachrymal of the fifth.
Inferior division of the third.
The sixth pair, lowest.

The trunk of the ophthalmic artery, at first below and to the outer side of the optic nerve, soon after crosses over to get to its inner side. The ophthalmic vein is situated below all the nerves.

Before proceeding with the eye and its appendages, we will speak of the muscles contained in the orbit. These are the four recti and two oblique muscles pertaining to the eyeball, and the levator palpebræ and tensor tarsi, which more strictly belong to its appendages.

The *levator palpebræ superioris* arises from the under surface of the lesser wing of the sphenoid, about one eighth of an inch anterior to the optic foramen, it passes forwards and upwards to be inserted into the margin of the tarsal cartilage; it is the highest muscle of the orbit. Its name signifies its action.

Immediately beneath and behind this muscle arises the *superior rectus*, which passes over the tendon of the superior oblique muscle to be inserted into the sclerotic coat of the eyeball at about two lines behind the edge of the cornea superiorly.

A little below and somewhat internal to the last muscle arises the *superior oblique*. It passes, first forwards and inwards to curve around a little pulley of bone or cartilage attached to the orbital plate of the frontal bone, from which point it turns somewhat backwards and outwards to be inserted into the sclerotic coat of the eye, after having passed under the tendon of the rectus superior. The obliquus superior is sometimes, as well as the nerve that supplies it, called *trochlearis*.

The internal, inferior, and one head of the external rectus, have a common and tendinous origin, situated on the little lamina of bone which separates the foramen opticum from the sphenoidal fissure, the other head of the external rectus arising immediately above the optic foramen. They are attached in a similar way to the superior rectus—to the external, internal, and inferior portions of the sclerotic coat.

Between the two heads of the external rectus pass the third and the sixth cranial nerves, and the nasal branch of the ophthalmic division of the fifth, and in some instances the ophthalmic vein.

The *inferior oblique* arises from a minute depression in the orbital plate of the superior maxillary bone, just within the margin of the orbit. It passes outwards and backwards between the inferior rectus and the floor of the orbit, to be inserted into the sclerotic at its external and posterior surface.

The action of the four recti is, when acting separately, to either raise, depress, or turn inwards or outwards the eye, and of course the action of two adjacent ones together will produce a compound movement. The whole four acting together tend to retract, and, as some think, to compress the eyeball, whilst the eyeball is supposed to be brought forward by the two obliqui.

Some anatomists, however, consider that the principal use of the obliqui is to rotate the eyeball on its axis, so that any small particles of extraneous matter may by this action be swept away.

The *tensor tarsi* is a small thin muscle, arising from the orbital surface of the lachrymal bone, and passing forwards and inwards over the lachrymal sac, to be inserted by two delicate tendons into the walls of the tubes leading from the puncta lachrymalia; it assists the passage of tears from the eye. It has been called Horner's muscle, from the name of its discoverer.

Before proceeding to the description of the eye, we shall mention the remaining appendages, which are the eyebrows, eyelids, and lachrymal apparatus.

The *eyebrows* consist of the integuments covering the supraorbital ridge of the frontal bone on each side. They contain adipose tissue and fibres of the occipito-frontalis and corrugator supercilii muscles, and are studded with hairs, extending in an arched direction from near the root of the nose to a little beyond the outer canthus of the eye.

The *eyelids* are two thin curtains covering the eye, and are superior and inferior. They consist of common integument externally, of mucous membrane internally, containing between them some very loose cellular tissue, which causes the lids to swell very rapidly from any effusion of blood or serum; the orbicularis palpebrarum; the tarsal cartilages; and, in the upper lid, fibres of the levator palpebræ superioris. Their points of union are called the external and internal canthus. Along the internal surface, near their edges, are numerous glandular bodies, called the *meibomian* glands or follicles, and at their margins a row of stiff hairs, called *cilia* or eyelashes. Near the internal commissure there are angular projections, each presenting a little orifice, named punctum lachrymale. These are surrounded by a fibro-cartilaginous ring, which serves to keep them patulous, and to allow the tears to pass from the surface of the eye into the lachrymal sac.

The tarsal fibro-cartilages differ in the two lids. The upper one is semilunar in form, with its convex thin edge uppermost; it is kept in its place by palpebral ligaments, connecting it internally with the tendo-oculi, superiorly and externally with the periosteum of the orbit. The lower fibro-cartilage is smaller, and of nearly equal thickness in its whole length, and is attached at its extremities in a similar manner to the upper one.

The *meibomian glands*, or sebaceous follicles, are more numerous in the upper than under eyelid; in the upper one there are about forty; in the lower one, half the number. They are arranged in vertical rows, and open by a smaller number of tubes at the edges of the lids. The secreted matter from them prevents the eyelids from sticking together, and in some measure prevents the tears from escaping over the edges of the lids.

Near the internal canthus, internal to the lids, are also seen two other bodies, the plica seminularis and the caruncula lachrymalis.

The *plica*, or *valvular semilunaris*, is a fold of mucous membrane of a triangular form; its base is concave towards the centre of the eye, its apex pointing to the inner canthus; it appears like a third eyelid, or rudiment of the membrana nictitans, in the owl, eagle, &c.

The *caruncula lachrymalis* is a small fleshy body of a red colour, composed chiefly of mucous follicles, studded with small hairs on its surface.

The lachrymal apparatus consists of the lachrymal gland and tubes, the puncta and lachrymal canals, the lachrymal sac, and nasal duct.

The *lachrymal gland* is situated at the upper and outer part of the orbit, resting against the lachrymal fossa of the frontal bone; it is from half an inch to an inch long, and about half an inch broad, composed of two lobes, consisting of a number of lobules like a conglomerate gland; from it seven or eight little tubes, *lachrymal ducts*, proceed, which open on the under surface of the upper eyelid, near the external canthus. The tears then pass along the surface of the eye towards the puncta lachrymalia, which they enter, and from which two canals are extended to the lachrymal sac.

The *lachrymal canals* leading into the sac differ in their direction; the upper one forms an angle in its middle course, looking upwards; the lower one is nearly straight, and if curved, it is so downwards; they are thus concave towards each other, and open almost by a single aperture into the sac.

The *lachrymal sac* is an elongated reservoir, situated behind the palpebral ligament, in a fossa formed by the os unguis and the nasal process of the superior maxillary bone, opening inferiorly into the nasal duct. It is lined by mucous membrane, and has a thin fibrous layer forming a periosteum.

The *nasal duct*, a continuation of the lachrymal sac of the nose to the inferior meatus, is about three quarters of an inch in length. Its direction is downwards, backwards and outwards. Its bony parietes are the os unguis, the superior maxillary bone, and the inferior spongy bone. It opens into the inferior meatus of the nose, having a fold of mucous membrane in front of it.

The *globe* or *ball* of the eye is composed of *membranes* or *coats*, *humours*, *vessels*, and *nerves*.

The *membranes* of the eye are the *tunica conjunctiva*, *sclerotica*, *choroidea*, *cornea*, *iris*, *retina*, the *hyaloid*, *capsule* of the *lens*, and *membrane* of the aqueous humour.

The *tunica conjunctiva* is a delicate mucous membrane reflected over the anterior third of the globe of the eye, and lining the internal parts of the eyelids; it is a continuation of the skin, and also of the mucous membrane of the nasal fossæ; it is most vascular where it lines the lids, less so upon the sclerotica, and least upon the cornea, upon which its epithelial layer only extends.

The *sclerotic coat*, so named from its hardness, is fibrous in structure, and continuous with the dura mater, through the medium of the optic nerve, covering about four fifths (according to some, five sixths) of the globe of the eye; it is thickest posteriorly, thinner at the sides, but thick again where it unites with the cornea; externally it is in apposition with the muscles, vessels, lachrymal gland and nerves; internally, with the choroid coat. It is perforated laterally and posteriorly by the ciliary nerves and vessels; and posteriorly, internally, and inferiorly, to the axis of the eye, by the optic nerve, which enters by several orifices in a cribriform manner. The tendinous expansion of the recti muscles upon the anterior part of the sclerotica has obtained the name of *tunica albuginea.*

The *cornea* is the transparent covering in front of the eye, about six lines in diameter, but which is slightly greater in the transverse direction; by its outer margin, which is bevelled off only in front, it is attached to the sclerotica, which slightly overlaps it, on account of which anatomists say that the cornea fits into the sclerotica, like a glass into a watch-case; externally, it is covered by the conjunctiva; internally, it is in contact with the membrane of the aqueous humour. It is convex anteriorly, concave posteriorly, and may be said to consist of five layers, viz., conjunctival, anterior elastic lamina, the cornea proper, posterior elastic lamina, and the membrane of the aqueous humour.

The cornea proper is a dense fibrous structure, consisting of numerous lamellæ, as many as from fifty to sixty in number, between the interstices of which a little fluid is found, which assists in preserving its transparency.

The *choroid membrane*, situated between the sclerotica and retina, is essentially vascular. It extends from the optic nerve to the ciliary ligament; near its anterior margin, it is thrown into folds or processes, which lie upon the edge of the lens and anterior portion of the vitreous humour; these are called *ciliary striæ*, or *processes.* On its outer surface are seen the ciliary nerves and long arteries; next come the veins of the choroid, *vasa vorticosa;* internally to them the short ciliary arteries which, by subdividing, form a beautiful network, named *tunica Ruyschiana;* next to this is the *tunica pigmenti,* which secretes on its inner surface the pigmentum nigrum, in some animals termed the *tapetum*.

The *ciliary striæ*, or processes, are very numerous, from seventy to eighty in number, alternately long and short, and conjointly named corpus ciliare. They are somewhat triangular in shape, and having pigmentum nigrum deposited upon them, when removed from the vitreous humour, they leave a radiated appearance.

The *retina*, as it is termed, consists of three membranes, the outer of which, in apposition with the choroid, is the *tunica Jacobi;* the middle one, the real expansion of the optic nerve, the *tunica nervosa;* the inner one is the *tunica vasculosa retinæ.* The extent of the retina anteriorly is not quite clear, some say, and amongst them Cruveilhier, that it only proceeds as far as the posterior edges of the ciliary striæ; others, that it passes as far as the crystalline lens.

The *tunica Jacobi* is an exceedingly delicate serous membrane, composed of two layers, according to some researches of Mr. Dalrymple, and forming a shut sac.

The *tunica nervosa*, the expansion of the optic nerve, is pulpy, and terminates at the edge of the ciliary processes.

The *tunica vasculosa* contains several minute branches from the arteria centralis retinæ, a small branch of which passes forward through the vitreous humour to reach the posterior surface of the capsule of the lens.

In the centre of the back part of the retina, in the axis of the globe of the eye, a yellow spot is observed, called the limbus luteus, with a fancied orifice, called foramen centrale of Sömmering. This is produced by a deposit of yellow substance; and the membrane being puckered up into a fold, causes the appearance of a dark spot or orifice in the centre.

The *iris* is a circular membrane, attached by its outer border to the ciliary ligament with a central orifice, called the pupil. Its anterior surface is coloured variously in different individuals; its inner surface is lined with a substance resembling pigmentum nigrum, named the uvea. It separates the cornea from the lens. In structure it appears to be fibrous, and, according to some, muscular. On the anterior surface two circles may be observed, the external one, named *annulus major*, is paler, and consists of fibres radiating from the circumference towards the centre; the inner fibres run circularly and form the *annulus minor*. The circular fibres of the iris are considered to be muscular whilst the radiating are considered to be simply elastic, but some describe them as positively muscular. On the posterior surface of the iris, the fibres pass straight from the circumference towards the pupillary margin.

The pupil of the fœtus, up to nearly the seventh month, is filled up by a membrane called the *membrana pupillaris;* this is supposed to be formed by a meeting of the membranes lining the two chambers of the eye, but seems more like a continuation of the iris, which is afterwards absorbed, in consequence of the pressure produced by the evolution and growth of the lens.

The space between the anterior surface of the iris and the cornea is called the *anterior chamber of the eye.* It is lined with a membrane which secretes the aqueous humour. A similar space exists between the posterior surface of the iris and lens, termed posterior chamber. The anterior chamber is about a fifth larger than the posterior.

The iris is supplied with blood by the long, short, and anterior ciliary arteries; by meeting and anastomosing at the external part of the iris, they form the *larger arterial circle;* and again, by anastomosing near the pupillary margin, they constitute the *circulus arteriosus minor;* its nerves are derived from the lenticular ganglion and nasal branch of the fifth; its veins empty themselves into the vasa vorticosa.

The external edge of the iris, by uniting with the choroid and sclerotic coats, forms a grayish circle, named the ciliary circle or ligament. The ciliary ligament is described by some as formed by the union of the cornea, choroid, and sclerotic coats. From its gray, pulpy appearance and nerves terminating in it, some have supposed it to be a nervous ganglion.

Between the ciliary ligament and sclerotic coat, a narrow circular canal may be found, most easily in the eye of the bullock, called the canal of Fontana.

HUMOURS OF THE EYE.

The *aqueous* humour contained within the anterior and posterior chambers, is secreted by its proper membrane.

In quantity it is about three drops; its use is to properly distend the cornea, to allow free motion of the iris, and to act on the direction of the rays of light as they pass through it.

The capsule of the aqueous humour possesses the power of regenerating the fluid when lost, either by accident or operation.

The *crystalline lens* is a transparent body, situate behind the iris, and in front of, but partially imbedded in, the vitreous humour. It is composed of concentric lamellæ, softest on the outside, and contained in a capsule, between which and the lens is a little fluid, named the liquor Morgagni.

When the human lens is hardened by boiling, and pressed upon with force, it splits into three triangular portions, the bases of which are formed by the edge of the lens.

In shape it is doubly convex; the anterior portion represents a small segment of a large sphere; the posterior one a larger segment of a smaller sphere, consequently it is most convex posteriorly. It is also covered by the hyaloid membrane, which at its edge separates into two layers, of which one passes in front, the other behind the lens, known as the canal of Petit; when inflated by a blowpipe it has a vesicular appearance.

Recent anatomists describe a special membrane under the name of the *suspensory ligament* of the lens, occupying the situation of the anterior layer of the hyaloid membrane, so that the canal of Petit is a triangular space surrounded by this ligament, the hyaloid membrane, and edge of the lens.

The vitreous humour, or *corpus vitreum*, which fills up the two posterior thirds of the eye, is perfectly transparent. It is contained in a number of cells, formed by processes of the hyaloid membrane, which also gives it a general covering. It is penetrated by branches of the arteria centralis retinæ, and is excavated anteriorly for the lodgment of the crystalline lens.

The orbit is supplied with blood from the ophthalmic artery, the veins unite to form the ophthalmic vein, which passes into the cavernous sinus.

The nerves entering the orbit are the 2d pair, 3d pair, 4th, first division of the 5th and 6th, besides which in the orbit is the lenticular ganglion.

THE EAR.

The ear, as commonly understood, consists of external and internal parts.

The parts of the external ear are the auricula and external auditory passage, or meatus; the parts of the internal ear are the tympanum and labyrinth.

The *auricula*, or outer ear, is composed of common integument, fibro-cartilages, muscular fibres, vessels, and nerves. The upper expanded portion is named the *pinna*, the lower small part the *lobe* or *lobule*, which is devoid of fibro-cartilage and muscle.

The prominent ridge forming the outer part of the pinna is named the *helix;* the bifid projection within it is named *antihelix;* the nipple-shaped prominence just in front of the meatus externus is the *tragus;* a small one behind and opposite to it the *antitragus*. The depression, or groove, between the helix and antihelix is the *fossa innominata*, that between the ridges of the antihelix is the *fossa navicularis*, and the deep fossa below it is the *concha*. The posterior surface of the concha is called the *dorsum* of the ear.

The outer ear is kept in its situation by fibrous bands, which attach it to the zygoma, the mastoid process, and temporal aponeurosis. It is moved by three muscles, the *anterior auris*, *retrahens*, and *attollens aurem*. There are also delicate muscles proper to the pinna of the ear, for the motion of separate parts, but so small as to be discovered with some difficulty; they are rudiments of like parts found in animals, and are the following:

Helicis major; helicis minor; tragicus; antitragicus; transversus auriculæ.

And two others described by Mr. Tod, viz.:

Obliquus auris; contractor meatus.

The meatus *auditorius externus*, or external auditory passage, extends from the concha to the membrana tympani. It is partly formed of cartilage and integument, partly of the latter and bone. The lining integument is also reflected upon the membrana tympani. Its direction is inwards and slightly forwards, arching a little superiorly, thus presenting a slight concave direction inferiorly. Its length is about an inch, but is somewhat longer inferiorly in consequence of the oblique position of the membrana tympani. Its broadest part is external, the narrowest in the middle. The integument lining this meatus is studded with a number of *ceruminous* glands, which secrete the peculiar thick fluid called wax of the ear, and at the outer part with a number of hairs.

This passage is separated from the internal ear by the membrana tympani.

The *membrana tympani* is nearly circular, attached by its circumference to a bony ring. It consists of three layers, the outer one a continuation of the common integument, the inner one continuous with the mucous membrane of the tympanum; the middle one is fibrous, and is the proper membrane. Its fibres converge from the circumference to the centre. It is slightly concave externally, convex internally. Its direction is oblique, as it looks downwards and outwards; to the centre of it internally, the long handle of the malleus is attached.

The *tympanum*, or drum of the ear, is a narrow cavity lined with mucous membrane, continuous with that from the Eustachian tube, bounded externally by the membrana tympani, posteriorly by the mastoid process and cells, and internally by the labyrinth. On its inner wall, about the centre, a prominence is seen, called the *promontory;* above this is a foramen, closed by membrane in the recent state, named *fenestra ovalis*, which communicates with the vestibule. Below the promontory, and more concealed by it is a round aperture, likewise closed in the recent state by membrane, called *fenestra rotunda;* it is in relation with the scala tympani. Along the posterior wall, behind the promontory, we find a little bony projection, named the pyramid; it presents a little orifice at its apex, which transmits the tendon of the stapedius muscle, the body of which is lodged in the bone; beneath this, and behind it, is a little foramen, which transmits the chorda tympani; superiorly and posteriorly is the opening from the mastoid cells.

Along the interior part of the tympani we meet with the glasserian fissure, which gives lodgment to the processus gracilis of the malleus, and passage to the chorda tympani and tendon of the laxator tympani muscle, a minute artery and vein. Anteriorly and internally we observe the orifices for the Eustachian tube, and tensor tympani muscle.

Within the tympanum is a chain of small bones, named *ossicula auditus*. They are the malleus, incus, orbiculare, and stapes.

The *malleus* (a hammer), in relation with the membrana tympani, consists of a head, neck, and processes. The *head* articulates with the incus; the *neck* is between this and the processes; the *manubrium* (handle) is a long process, connected by its extremity with the membrana tympani. The processus brevis is external, passes from the neck at a right angle, and rests against the membrana tympani. The processus gracilis proceeds from the neck, forwards and downwards, and is inserted by its point into the glenoid fissure.

The *incus* (an anvil) may be divided into a body and processes. The body is anterior, and is articulated at its upper part with the head of the malleus. Its short crus, or process, is directed backwards, and retires into the mastoid cells; its long process, or crus, passes forwards, downwards, and inwards, terminating in a rounded point, which has been named as a separate bone, the *os orbiculare*, by which it is articulated with the stapes.

The *stapes* (a stirrup) is said to consist of a base, processes, a neck, and head. The *head* is articulated with the incus; the *neck* has the stapedius muscle attached to it; the *processes* pass from the neck to the base, and have a delicate membrane filling up the space between them; the *base* of an oval form fills up or occupies the opening, named *fenestra-ovalis*.

These bones admit of some motion, which are influenced by some minute muscles, the smallest in the body. They are four in number:

The *tensor tympani* arises from—

the upper surface of the cartilage of the Eustachian tube and petrous bone;

and is inserted into—

the processus brevis of the malleus.

The *laxator tympani* arises from—

the spinous process of sphenoid bone;

and is inserted into—

the processus gracilis of the malleus.

The *laxator tympani minor* has its origin from—

the bony circumference of the membrana tympani;

and is inserted into—

the manubrium of the malleus, near the short process.

The *stapedius* arises from—

the tube of the pyramid;

and is inserted into—

the neck of the stapes.

The *Eustachian* tube is partly formed of bone and partly of cartilage, the cartilaginous portion forming about two thirds of it. It is narrowest about the middle third, broadest at its anterior part. Its direction from the ear is forwards, inwards, and a little downwards. It opens opposite the posterior part of the inferior spongy bone. The bony portion is separated from the tensor tympani muscle by a thin bony partition, called *processus cochleariformis*. The cartilage does not completely surround the tube; it is deficient at the inferior external part, which is filled up by a fibrous substance.

The *labyrinth* consists of the vestibule, cochlea, and semicircular canals. It is lined with a delicate membrane, which is bathed by a thin fluid, named *aqua labyrinthi*, and contains the ramifications and expansions of the auditory nerve, thus constituting the principal part of the organ of hearing.

The *vestibule* is a cavity somewhat larger than a grain of pearl barley. It is nearly filled with the expansion of the portio mollis, is lined with a delicate membrane, between which and the nerve is the *liquor Cotunnii* or *aqua labyrinthi*. Its boundaries are:

Anteriorly, the cochlea.
Posteriorly, the semicircular canals.
Internally, the lamina cribrosa, for the portio mollis.
Externally, the osseous plate forming the promontory.
Superiorly, the bone, containing the aqueduct of Fallopius.

The openings into it in the dry bone are—the fenestra ovalis, externally; five openings from the semicircular canals, posteriorly; one from the scala vestibuli, anteriorly; the foramina for the auditory nerve, internally; and from the posterior and external part a foramen which transmits a small vein, and is named *aquæductus vestibuli.*

The *cochlea* is situated in front of the vestibule, in the hardest portion of the petrous bone. It is named from its resemblance to the spiral tubes of a shell. It may be described as a spiral bony tube, which makes two turns and a half round an axis or pillar, named *modiolus.* This tube is separated by a delicate lamella in the recent state, into two distinct tubes, which are named the *scala tympani* (the staircase of the tympanum), and *scala vestibuli,* in consequence of one opening into the vestibule, the other communicating with the tympanum at the fenestra rotunda, with the intervention of a delicate membrane. The lamella is formed of bone towards the modiolus, and does not quite extend to the top of the tube, the rest is membranous, and extends as far as the *cupola,* which is the extreme point where the two scalæ communicate.

The base of the modiolus is opposite to the entrance of the portio mollis from the internal auditory meatus, and is here perforated for the little nervous filaments and vessels; the passage in the modiolus expanding at the top, is called the *infundibulum.*

Near to the point where the scala tympani communicates with the fenestra rotunda, a small foramen exists, which transmits a vein, and is named *aquæductus cochleæ.* It opens into the lateral sinus near the jugular fossa.

The *semicircular* canals are three in number, and, from their direction, are named superior or *vertical,* external or *horizontal,* and posterior or *oblique;* they are situated in the petrous bone, not so deeply imbedded as the cochlea, and each of them forms rather more than half a circle; they are lined with a delicate membrane, and contain the pulpy expansion of the portio mollis contained within the membranous labyrinth, with a little fluid intervening between the nerve and the canals. They open by each extremity into the vestibule; but, as the vertical and posterior canals unite together by their continuous extremities before communicating with the vestibule, there are only five, instead of six, openings into the vestibule.

The *meatus auditorius internus*, is a bony canal in the posterior surface of the pars petrosa, giving passage to the portio mollis, portio dura, and an artery, which runs somewhat between the two nerves. At the bottom of this canal a little bony ridge is seen, separating it into two parts, the superior smaller, and the inferior cribriform plate. Through the upper opening the portio dura passes; through the lower, the portio mollis and the artery.

The superior passage, or tube, is the aqueduct of Fallopius; it passes upwards and outwards, then downwards and outwards, and then backwards and downwards; at first above the cochlea, then runs over the roof of the tympanum and terminates at the foramen stylo-mastoideum. It conveys the vidian nerve and portio dura, which in its course gives filaments to pierce the bone, and supply the tensor tympani and stapedius muscles.

The auditory nerve at the bottom of the meatus divides into numerous filaments; some pass into the foramina of the modiolus, and in their passage perforate its walls, and arrive at the lamina spiralis, and walls of the scala, upon which they are spread out in the most delicate manner. A second set in the vestibule expand almost to fill up this cavity, and receive investments from a membrane, named membranous labyrinth, and these are named *sacculus* and *utriculus vestibuli*. The third series mount up over the former, and enter the semicircular canals. On entering them, the nerves appear to expand into a pulpy mass, which partly fills up the tubes; they are supported by the liquor Cotunnii. The arteries, which are very delicate, are, at first, the branch from the basilar or posterior cerebral, which enters by the lamina cribrosa, and ramifies in the labyrinth; second, a *stylo-mastoid* branch, from the posterior auricular, enters the tympanum, supplies minute branches to it, the mastoid cells and labyrinth sometimes forming an arterial circle round the membrani tympani by uniting with the artery which enters by the fissura glasseri; third, the tympanic branch given off from the internal maxillary artery, it enters through the fissura glasseri, ramifies in the tympanum, and anastomoses freely with the stylo-mastoid branch. The veins corresponding with the last-named arteries take a similar course; but those of the labyrinth terminate in the (improperly named) aqueducts of the vestibule and cochlea, which convey the blood to the lateral sinuses.

THE NOSE.

The bones which enter into the formation of the nose are fourteen in number, consisting of all the bones of the face, excepting the two malar and inferior maxillary, and three bones which are described as common to the head and face, viz., the frontal, ethmoid, and sphenoid. By a central partition, the nose is divided into two distinct fossæ. This septum of the nose is formed by the vomer, nasal lamella of the ethmoid bone, and an extensive cartilage. The roof of the nose has a flattened surface in the centre, shelving down anteriorly and posteriorly. It is bounded anteriorly by the nasal bones, superiorly by the frontal bone and cribriform plate of the ethmoid bone, and posteriorly by the body of the sphenoid. The floor is formed by the superior maxillary and palate bones, and the outer wall by the ethmoid, internal pterygoid plates, os unguis, inferior spongy bone, palate-bone, and superior maxillary. The inner wall is the septum.

Each nostril is divided into chambers by the spongy bones. These chambers are named *superior*, *middle*, and *inferior meatus*. The openings into these, in addition to the anterior and posterior common openings, or nares, are the following: in the *inferior meatus* is the opening from the nasal duct, concealed by a fold of mucous membrane. In passing a probe into it, the instrument must be curved and carried just beyond the fold, and then, by turning it outwards, it may be made to enter the duct, and in the dry bones we find the anterior palatine foramen or canal.

The openings into the *middle* meatus are: one from the maxillary sinus, one from the frontal sinus, and anterior ethmoidal cells.

In the *superior* meatus we find the opening from the posterior ethmoidal cells and sphenoidal sinuses; and, in the dry bones, the spheno-palatine foramen.

At the anterior part of the floor, on each side, in the dry bone, is the superior orifice of the anterior palatine canal.

The *Eustachian tube* might almost be said to enter the nares. Its anterior aperture corresponds with the posterior part of the inferior spongy bone; when a probe has to be introduced into it, it should be carried immediately under the inferior spongy bone, and when it has arrived at the extremity of that bone, it should be guided a little upwards, outwards, and backwards.

The posterior nares or apertures are oblong in the perpendicular direction, compressed laterally; bounded above by the sphenoid bone; externally, by the internal pterygoid plates; internally, by the vomer; and inferiorly by the palate-bone.

The mucous membrane of the nose is named *pituitary*, or *Schneiderian;* it is continuous with the common integument anteriorly, and with the mucous membrane of the pharynx posteriorly; it is red, soft and villous, especially about the spongy bones; anteriorly smoother and studded with hairs, and exceedingly adherent to the periosteum; but, in the cells and maxillary sinus it is thin, very pale, and slightly adherent to the bones.

The softer anterior part, consisting of the alæ and tip of the nose, is formed of common integument and cartilages; these are five in number, one central and two lateral on each side; the anterior one, elongated from above downwards, is somewhat triangular in shape, broadest superiorly, where it is attached to the perpendicular plate of the ethmoid bone. Of the lateral cartilages, the superior one is triangular, and attached to the nasal and superior maxillary bones, and anteriorly rests against the perpendicular cartilage; the inferior lateral cartilages, most particularly, give form to the alæ nasi. They are arched and convex externally; connected above with the superior lateral cartilage, externally to the superior maxillary bone, and anteriorly are loosely connected with the perpendicular cartilage. In addition to these five, there are some smaller cartilages, which are uncertain as to number, and not definite in their form.

The arteries of the nose are derived from the labial, internal maxillary and ethmoidal. The nerves are branches of the olfactory, or first pair, the nasal division of the fifth, and branches from Meckel's ganglion.

THE TONGUE.

The tongue is not only the organ of taste but assists materially in deglutition, suction, speech, and touch. It may be described as formed by muscles, arteries, veins, nerves, and its papillæ, or most sensitive portions. In shape the tongue is oblong, coming to a point anteriorly. Its dorsum is convex, but marked in its centre by a groove or raphé, which divides it into two lateral symmetrical parts. Upon its inferior surface is the frænum which separates the two sides, and connects the tongue with the floor of the mouth, and mesial line of the lower jaw.

Upon the superior and posterior surface of the tongue is seen a little round depression, called the *foramen cæcum*, which forms a small reservoir for the mucous secretion of the follicles placed in its neighbourhood.

The muscles of the tongue are generally described as five in number, viz., the hyoglossus, the genio-hyoglossus, lingualis, styloglossus, and palatoglossus.

The *styloglossus* (most external) arises from the styloid process of the temporal bone, and the stylo-hyoid ligament; it passes forwards and downwards to be inserted along the side of the tongue.

The *hyoglossus* arises from the whole of the great cornu and part of the body of the os hyoides, and passes upwards and forwards to be inserted into the whole side of the tongue, crossing the styloglossus muscle, internal to which it lies.

The *lingualis* (the next deepest) has but a slight bony attachment to the os hyoides; it passes forwards along the whole side of the tongue, and is blended inseparably with its substance.

The *genio-hyoglossus* (most internal) arises from a little tubercle inside the symphysis of the lower jaw, from which point the fibres spread out like a fan, the lowest to be inserted into the os hyoides, the highest to reach the tip of the tongue, the intervening fibres being attached all along its lower surface from the one point to the other. It forms the posterior part of the frænum linguæ, the anterior being little more than membrane.

Immediately beneath the genio-hyoglossus arises another muscle, which, though not commonly reckoned among tion of the tongue, has a considerable effect in drawing it forwards. From its arising from the lower jaw immediately behind the symphysis, and being inserted into the body of the os hyoides, it has been named the *genio-hyoideus*.

The *palato-glossus* arises from the soft palate, and passes downwards, outwards, and forwards, to be inserted into the side of the tongue. This muscle is common to the tongue and palate, and is also called the *constrictor isthmi faucium*.

Besides these muscles the tongue is composed of a considerable mass of structure closely approaching to muscular, though not resembling it much. Thin layers of this substance run along the tongue from before backwards, both above and at the sides, whilst other strata run directly from side to side, a third variety appearing to pass almost perpendicularly downwards.

The mucous membrane of the tongue which covers its superior and lateral surfaces, is studded with a vast number of papillæ, which form the seat of the organ of taste. They are divided into several varieties, called the following:

1. *Papillæ maximæ*, also called *circumvallatæ* and [illegible]. These are about fifteen in number; they are arranged in two rows, which meet in a point posteriorly at the foramen cæcum. They are but slightly elevated, and have a little depression in their centre, whence their name.

2. *Papillæ capitatæ* or *fungiformes*.—These are in appearance like small mushrooms. They cover the whole of the tongue, but are found principally at the sides and point.

3. *Papillæ pyramidales* or *conicæ*.—These are, as their name implies, larger at their base than their point. They are very numerous, diffused over the whole surface of the tongue.

4. *Papillæ filiformes*.—These are very small and somewhat thread-like. They are very few in number, and only found near the apex of the tongue. Unlike the other three varieties, these appear merely to contribute to ordinary sensation, whilst the others assist both the ordinary and special sense.

From the circumstance of the sensation of taste being more powerful at the posterior part of the tongue, whilst ordinary sensation is considerably more acute at its point, it has been supposed that the gustatory nerve (from the fifth) is the nerve only of ordinary sensation, and the glosso-pharyngeal the true nerve of taste. No doubt at all, however, exists with regard to the lingual or ninth nerve, it being the motor nerve of the tongue, and distributed only to its muscles.

The arteries which supply the tongue are derived from the lingual, a branch of the external carotid artery. They are, the dorsalis linguæ, which supplies the dorsum; the sublingual, which supplies the posterior portion; and the ranine, which supplies the anterior and inferior surface and tip of the tongue.

Its principal veins are the ranine; these are very conspicuous when the tongue is turned up.

Having spoken of the organs of the four special senses we shall now turn to the consideration of the fifth sense, that of touch. The chief seat of this is the skin.

THE SKIN.

The skin is a membrane of variable thickness, which covers the whole body, and is reflected inwards by all the natural openings, so as to line, by its internal reflections, the eye, the nasal fossæ and the neighbouring cavities, the mouth, the air-passages, the alimentary canal, and the urinary passages. These internal portions change their properties, becoming soft and moist, and from their secreting a peculiar fluid for their lubrication, are known as mucous membranes.

Speaking in general terms, the two great mucous membranes of the body are, the gastro-pulmonary and the genito-urinary; the former lining the air-passages and the organs of digestion, the latter the genital and urinary apparatus.

The skin is generally described as composed of three layers, the cuticle, the rete mucosum, and the cutis vera, the latter being the most internal.

The *cutis* (*dermis*), or true skin, consists of two layers, of which the deeper is called the *corium*, and the more superficial the *papillary layer*.

The *corium* is composed of numerous fibres closely interlaced, and forming a smooth surface for the support of the papillary layer. It is very thin in the eyelids and genitals, but thick on the palms of the hands and feet, scalp, &c. As a rule, it is thick on the exposed parts of the body and thin on the protected.

The papillary layer is soft, and formed by numerous papillæ which cover its whole surface. They are arranged promiscuously over the whole surface of the body, but are quite symmetrical in the skin of the fingers, where they form regular, well-defined rows.

The papillary layer is very vascular, and contains the expansions of the sensitive nerves.

Immediately beneath and intimately connected with the cutis vera is found, in some animals, a peculiar muscular structure, called the pannicului carnosus.

The *rete mucosum* is now considered to be simply the innermost soft layer of the cuticle or epidermis. It is accurately moulded to the cutis, whose inequalities it partially diminishes, being thicker between the papillæ and thinner on their summits. It is composed of minute nucleated cells, which are oval in shape, and become flattened into scales when forming the cuticle. This layer, which is almost fluid and very slightly developed in the white races, is very distinct and thick in the darker races of mankind, in which also the cells are filled with a pigment that gives the characteristic colour to their skin. In fact the rete mucosum has sometimes been described as a distinct pigment layer in the negro, in whom it is easily separable by maceration.

The cuticle (scarf-skin, epidermis) is formed by the outer hardened layers of the rete mucosum; it is quite unorganized and horny in structure, its use being to protect from injury the more delicate subjacent cutis. In appearance it is always wrinkled, from its inelastic nature, though this is not equally apparent in all parts of the body. It covers the whole surface, and is reflected internally at all the natural openings, forming the epithelium of the mucous membranes. The cuticle is thickest in the most exposed parts of the body, consisting of several layers in the palms of the hand and soles of the feet.

The appendages of the skin are, the nails, hairs, sebaceous glands, and perspiratory glands and ducts.

The nails are parts of the cuticle, and composed of the same material, but disposed in a peculiar way, to protect the sensitive extremities of the fingers. Their posterior extremities are inserted into a deep groove in the skin, called their matrix, whilst their anterior or harder extremity is free. Beneath, they are closely connected to the skin by longitudinal laminæ. The posterior whiter portion is, from its shape, called *lunula.* The nails come off with the cuticle when the hand is macerated long in water.

The *hairs* are secreted from little pouches in the skin, at the bottom of each of which is a papilla. They are hollow in shape, and split into two or three at their free end. The hairs of the head are round, but those of the other parts of the body are more or less flattened, and sometimes even prismoid in form.

The *sebaceous* glands vary in shape, being large in the nose and in the armpits, and very small in most other parts, and are formed by one or more small lobules opening into an excretory duct, which pierces the rete mucosum and cuticle to reach the surface of the skin; some of the ducts, however, only open into the hair follicles, and reach the skin by those means. The sebaceous glands are lodged in the cutis, but do not lie so deep as the sweat-glands.

The *sudoriparous* (perspiratory or sweat) glands are situated in the lowest part of the corium. They are small and lobulated, and give off a duct which ascends to the surface, in most parts of the body in a convoluted manner, but in the scalp perpendicularly.

The openings of the ducts may be easily seen at the ends of the fingers, resembling small lines crossing the ridges of the cuticle. These openings are called the pores of the skin, and not only give passage to the sweat, but to carbonic acid and other exhalations.

The passage of carbonic acid from the skin may be readily seen on putting the hand into lime-water, from which the carbonate will be speedily thrown down, so as to cover the whole hand with a white powder.

Beneath the chorion is found the adipose tissue, and beneath this is the true reticulated or cellular tissue which forms the superficial facia of the body.

Having thus briefly considered the anatomy of the senses, we will proceed with that of the viscera.

THE MOUTH, PHARYNX, AND ŒSOPHAGUS.

The bony parts of the mouth are, the superior and inferior maxillary, the palate-bones, and the teeth.

The first teeth in the child are temporary, and are usually twenty in number. About the seventh or eighth year they are replaced by the permanent teeth, which, when complete, are thirty-two in number.

The teeth of a child, that is, the first set in each jaw, are four incisores, two cuspidati or canini, and four molares.

In each jaw of the adult there are four *incisores*, two *cuspidati* or *canini*, four *bicuspidati*, and six *molares*. The posterior molares, which protrude often late in life, have been named *dentes sapientiæ*. The first, or anterior molares, are the earliest of the permanent teeth which show themselves above the gums.

The soft parts of the mouth are, the cheeks and lips, the gums, the soft palate and the uvula, the tongue, the lining membrane, and salivary glands.

The cheeks and lips are formed by common integument and muscle, and are studded with glands, named buccal and labial, which secrete fluid very like saliva.

The soft palate is the loose fleshy curtain which hangs down from the palate-bones, forming a partition between the mouth and the pharynx, and consists of five muscles, enclosed in a mucous membrane. There is a small fleshy substance projecting from its centre, called the *uvula*, from which two folds of membrane diverge, forming the *anterior* and *posterior arches* of the *palate*. The former passes to the side of the tongue, the latter to the pharynx. In the triangular space between them is a glandular body, named the *amygdala* or *tonsil*.

The *tonsils* consist of an aggregation of follicles, which secrete a thick mucus. They are bounded by the palato-glossus, anteriorly; the palato-pharyngeus, posteriorly; the stylo-glossus muscle, inferiorly; and the mucous membrane, internally.

The muscles of the soft palate are, the *levator palati*, the *circumflexus* or *tensor palati*, the *azygos uvulæ*, the *palato-glossus* or *constrictor isthmi faucium*, contained in the anterior arch, and the *palato-pharyngeus*, imbedded in the posterior arch.

The *uvula*, which hangs down from the centre of the anterior arches of the palate, consists of mucous membrane surrounding muscular fibres, named the *azygos*, or *levatores uvulæ*.

The opening from the mouth into the pharynx, also named *isthmus faucium*, is bounded superiorly by the velum pendulum palati, laterally by the tonsils and arches of the palate, and inferiorly by the tongue.

The *salivary glands* are, the *parotid*, *sublingual*, and *submaxillary*, on each side.

The *parotid gland*, so named from its situation near the ear, is bounded—

Anteriorly,	by the ramus of the jaw.
Posteriorly,	by the mastoid process and external auditory meatus.
Internally,	by the styloid process and its muscles.
Externally,	by fascia, fibres of the platysma, and integuments.
Superiorly,	by the zygoma.
Inferiorly,	by the angle of the jaw and digastric muscle.

It surrounds within its substance the external carotid artery, with the roots of the temporal, internal maxillary and transverse facial branches, the temporal and internal maxillary vein, the portio dura, auricular nerve of the cervical plexus, auricular branch of the fifth pair of nerves, and some lymphatic glands. Internal to the styloid muscles and this gland we find the internal carotid artery and internal jugular vein.

The *parotid* is a conglomerate gland, and consists of a series of lobules, made distinct by the vessels and nerves, and partly by the fascia, which covers it externally, forming a species of capsule; one portion of it overlaps the masseter muscle, and has been named *socia parotidis;* a portion of it posteriorly and superiorly occupies part of the glenoid cavity. From these several lobes little ducts converge to form the parotid or *stenonian duct*. This duct runs forward upon the masseter muscle, nearly an inch below the zygoma, passes through a quantity of fat, which rests on the buccinator muscle, then perforates this muscle, and opens into the mouth opposite about the second molar tooth. It consists of two coats, the lining one mucous, continuous with the membrane of the mouth, and an outer one, fibrous. It is narrowest in its centre, somewhat dilated at each extremity, and is accompanied by the transverse facial artery and middle division of the nerves from the pes anserinus.

The *submaxillary gland* occupies part of the space between the lower jaw and digastric muscle. It is bounded above by the lower jaw, the mylo-hyoideus, and hyoglossus muscles; externally by the jaw, fascia of the neck, platysma, and common integuments; below by the digastric muscle. The facial artery grooves it, along its posterior part, and sometimes appears to separate it into two lobes. Its structure is like that of the parotid.

The excretory duct, named *Wharton's*, passes obliquely upwards and inwards, parallel with the gustatory and lingual nerves. After passing between the mylo-hyoideus and hyoglossus muscles, it runs between the sublingual gland and genio-hyoglossus, immediately under the mucous membrane, along the frænum linguæ, as far as a prominent papilla, just behind the inferior incisor teeth, where it opens by an exceedingly small orifice.

The Whartonian duct has much thinner coats than the stenonian, its calibre is greater, and it is more dilatable; and when distended by fluid or calcareous matter, projects considerably into the cavity of the mouth.

The *sublingual gland* of each side rests against the sublingual fossa of the lower jaw, on each side of the symphysis; smaller than the other salivary glands. It is placed beneath the mucous membrane, lies upon the mylohyoid muscle, and rests against the lower jaw; internal to it is the genio-hyoglossus, from which it is separated by the gustatory nerve, Wharton's duct, and the ranine vein; anteriorly, it reaches the border of its fellow gland, at its posterior edge it is embraced by the gustatory nerve, which supplies filaments to it.

The excretory ducts (*ducts of Rivinus*) are seven or eight in number; they open along the ridge on the side of the frænum linguæ. Some of them have been found to pass into the Whartonian duct.

These salivary glands are so placed that, by the action of mastication, they should be exposed to pressure, which will force out the fluid at the time when it is most required.

The *pharynx* is a musculo-membranous bag, somewhat of the shape of a funnel; it is broadest about its middle, more constricted superiorly, but most so inferiorly, where it terminates in the œsophagus.

It is bounded posteriorly by the cervical vertebræ; superiorly, by the base of the skull; laterally, by the large vessels of the neck, and by muscles; anteriorly, by the soft palate, tongue, glottis, and larynx; inferiorly, it terminates in the œsophagus, opposite the fifth cervical vertebra.

Internally it consists of mucous membrane, on the outside of which are the muscles which chiefly form its parietes. They are the *superior*, *middle*, and *inferior constrictors* of each side; accessory to them are the *stylo-pharyngeus* and *palato-pharyngeus*. In addition to these parts, Cruveilhier describes a membranous or aponeurotic layer, between the mucous membrane and muscles, which consists of two portions, named cephalo-pharyngeal and petro-pharyngeal. Posteriorly it serves as a point of attachment to the pharyngeal muscles.

The *inferior constrictor* most superficial, overlapping the middle constrictor, partially arises from two or three rings of the trachea, and from the sides of the cricoid and thyroid cartilage, it passes backwards to be inserted into the posterior tendinous raphé of the pharynx.

The *middle constrictor* arises from the cornua of the os hyoides, and slightly from the stylo-hyoid ligament, from which points its fibres spread out to be inserted, the lower and middle into the raphé, and the superior, by a tendinous prolongation, into the basilar process of the occipital bone. Its superior border overlaps the superior constrictor, whilst its inferior is overlapped by the inferior constrictor.

The *superior constrictor* of the pharynx arises, slightly from the side of the tongue, from the molar ridge of the inferior maxilla, from the pterygo-maxillary ligament, and from the internal pterygoid plate and hamular process; it passes backwards to be inserted into the central raphé of the pharynx, and into the basilar process of the occipital bone. Its lower portion is overlapped by the middle constrictor.

The *stylo-pharyngeus* arises from the styloid process, from which it passes downwards and forwards, between the superior and middle constrictors, to be inserted into the side of the pharynx, and the posterior border of the thyroid cartilage.

The *palato-pharyngeus* arises from the aponeurosis of the soft palate, and passes downwards to be inserted into the side of the pharynx, and slightly into the thyroid cartilage.

There are seven openings into the pharynx, viz., two from the posterior nares, two into the Eustachian tubes, one into the mouth, one into the larynx, and the seventh into the œsophagus.

The *œsophagus* is a cylindrical tube, the narrowest portion of the alimentary canal, extending from the pharynx to the stomach, from about the fifth cervical vertebra to opposite the tenth dorsal. It is at first placed behind the trachea; in the chest it is inclosed in the posterior mediastinum, at first rather to the right of the arch of the aorta; about the centre of the chest it inclines over the aorta, and lower down is in front, but a little to the left of it. It does not pass exactly in the mesian line, for its upper part, in the chest, is a little inclined to the right, and its lower part to the left side. It has two series of muscular fibres, circular internally and longitudinal externally, which are in some degree collected together, so as to form three fasciculi, one on each side, and one in front; it is lined internally by a mucous membrane, continuous from the mouth and pharynx, also by squamous epithelium.

It receives its blood from the inferior thyroid arteries in the neck, but in the thorax has arteries direct from the aorta. It is accompanied in most of its course by the par vagum, which, with the sympathetic in the upper part of the chest, forms a plexus around it, called œsophageal.

LARYNX, TRACHEA, AND BRONCHI.

The *larynx* is composed of cartilages, numerous ligaments, muscles, and lining mucous membrane, with its arteries, veins, nerves, and absorbents.

It is situated in the front and middle of the neck, anterior to the pharynx; connected with the os hyoides superiorly, with the trachea inferiorly, and bounded laterally by muscles and the large vessels of the neck.

It is nearly a third larger in the male than in the female.

The thyroid cartilage, which is the largest, is placed anteriorly. It is formed by two lateral portions or *alæ*, of a quadrangular shape, united anteriorly at an acute angle, where they form a projection, termed *pomum Adami*, most prominent in the male. At its superior posterior angle, on each side, there is a projecting portion named its *superior cornu*, which is attached by a lateral thyro-hyoid or round ligament to the os hyoides. There is frequently found in this ligament a small portion of bony matter.

The inferior margin, convex in the centre, is connected by the crico-thyroid ligament to the cricoid cartilage. At the posterior inferior angle another projection is found, named the *inferior cornu*, which is connected with the cricoid cartilage by the lateral crico-thyroid ligament, and a synovial membrane.

The *cricoid* cartilage is of the form of a ring, with its broadest or signet portion posteriorly. It lies beneath the thyroid cartilage, and above the first ring of the trachea. It is connected with the former by the crico-thyroid ligaments, and with the latter by a broad process of ligamentous substance.

Its superior margin inclines downwards and forwards, its inferior one is horizontal. On its posterior superior margin are observed four smooth articulating surfaces, the direction of which is upwards and outwards. The inner surface on each side receives the base of the arytenoid cartilage; the outer ones articulate with the inferior cornua of the thyroid cartilage. The posterior surface of the cricoid is furrowed by the crico-arytenoidei postici muscles. In old age this cartilage is frequently ossified.

The *arytenoid* cartilages are two in number, of a pyramidal figure, attached at their base by capsular ligaments to the upper edge of the cricoid cartilage.

They have a little cartilaginous appendage on the summit, named *corniculum laryngis*, which is attached by ligaments and a synovial capsule.

Their posterior surface is a little hollowed out, for the insertion of the transverse and oblique arytenoïd muscles.

To their anterior surface, which is rather convex, and to the apex, are attached ligamentous fibres, which pass to the inside of the projecting part of the thyroid cartilage, and to the epiglottis.

These cartilages are sometimes ossified.

The *epiglottis* in texture is not strictly cartilaginous; it belongs rather to the fibro-cartilaginous tissue, known by the French as *tissue jaune*.

It adheres inferiorly to the interior part of the thyroid cartilage by a strong elastic ligamentous substance.

It is somewhat oval, or is likened to an obcordate leaf, rather convex above, concave below, covered by mucous membrane, and studded with numerous mucous follicles.

It is kept in its situation also by ligaments, extending from the base of the tongue, and likewise by two ligaments, which proceed from its sides to the arytenoid cartilages.

Between the epiglottis and the dorsum of the tongue is found a small mass of fatty substance, incorrectly called the epiglottic gland.

The ligaments of the larynx are by some considered to be seventeen in number. They are, three broad, four capsular, two round, four thyro-arytenoid, and four connected with the epiglottis.

The broad ligaments are—

The thyro-hyoid, connecting the upper edge of the thyroid cartilage with the internal surface of the os hyoides. It is also named thyro-hyoid membrane.
The crico-thyroid, through which the operation of laryngotomy is performed.
The ligamentous substance between the cricoid cartilage and the first ring of the trachea.

The capsular ligaments are four. They are on each side.

Crico-arytenoid, Crico-thyroid.

The two round ligaments extend from the superior cornu of the thyroid cartilage to the extremity of the great cornu of the os hyoides on each side.

The *thyro-arytenoid ligaments* are superior and inferior on each side. The inferior only are really ligamentous, and form the true chordæ vocales; they pass from the base of the arytenoid cartilages to the inside of the angle of the thyroid. The superior, so-styled ligaments, are folds of mucous membrane, passing from near the apex of the arytenoid cartilages to the same point as the former.

Between the two, on each side, is a fossa, named *sacculus laryngis*, or ventricle of Galen.

The four ligaments of the epiglottis are—

Thyro-epiglottidean, really ligamentous,
Glosso-epiglottidean, a fold of mucous membrane, named frænum epiglottidis,
Two aryteno-epiglottidean, also consisting of mucous membrane.

The muscles connected with the larynx, and concerned in its motions, are, anteriorly, the *sterno-thyroid*, *thyro-hyoid*, and *crico-thyroid;* posteriorly, the *crico-arytenoidei postici*, and the *arytenoidei;* and laterally, muscular fibres, which have been named *crico-arytenoidei laterales*, and *thyro-arytenoidei*.

In addition to these muscles, three more have been described by the minute anatomists, viz., the *thyro-epiglottideus*, the *aryteno-epiglottideus*, *superior* and *inferior*, on each side.

The *sterno-thyroid* and the *thyro-hyoid* muscles have their origin and insertion clearly indicated by their name. Their action is simply upon the larynx as a whole, the former depressing, the latter assisting to raise it.

The *crico-thyroideus* is a very small fan-shaped muscle, of which the point arises from the centre of the cricoid cartilage, and the expansion is inserted into the lower and inner portion of the side of the thyroid.

The *crico-arytenoideus posticus* is a small square-shaped muscle on each side, arising from a depression on the posterior surface of the cricoid cartilage, and passing upwards and outwards to be inserted into the base of the arytenoid.

The *arytenoideus* is by some authors divided into three, viz., the *arytenoidei transversi*, and *obliqui*. It is, however, better to describe it as one muscle, of which the deepest fibres pass transversely from one arytenoid cartilage to the other, whilst the more superficial pass obliquely from the top of one arytenoid cartilage to the base of the other, thus forming a St. Andrew's cross in appearance.

The remaining muscles are all situated within the larynx.

The *thyro-arytenoideus* passes from the internal angle of the thyroid cartilage to the base of the arytenoid.

The *crico-arytenoideus lateralis* passes from the internal surface of the cricoid cartilage to the base of the arytenoid at its outer angle.

The *thyro-epiglottideus* seems to be but a few of the upper fibres of the thyro-arytenoideus muscle.

The *aryteno-epiglottideus superior* is a very small and indistinct muscle, passing in the fold of mucous membrane, commonly known as the false chorda vocalis.

The *aryteno-epiglottideus inferior* is a better developed muscle than the preceding, and by its action can diminish or alter the shape of the sacculus laryngis.

From its having been most accurately described by Mr. Hilton, it has received the name of *Hilton's muscle*.

The arteries of the larynx are, the superior laryngeal or thyroid, from the external carotid; and inferior laryngeal, from the subclavian.

The mucous membrane of this organ is studded with numerous follicles, some of which have obtained the name of glands; some of these aggregated just above the epiglottis, between it and the tongue, imbedded in some fat, from the so-called *epiglottidean gland*, whilst others, situated near the arytenoid cartilages, have been called the arytenoid glands.

The nerves are chiefly from the pneumogastric, the superior laryngeal being a nerve of sensation, the inferior laryngeal the true nerve of motion and of voice.

The *trachea* extends from the cricoid cartilage to the bronchi, from about the fourth cervical vertebra to opposite the third dorsal. It is covered anteriorly by the sterno-hyoid and sterno-thyroid muscles, and thyroid gland; posteriorly it is in contact with the œsophagus; laterally it is bounded by the large vessels of the neck, the nervus vagus and sympathetic nerve, and in the chest is crossed by the left vena innominata, somewhat by the arteria innominata, and the arch of the aorta.

Its figure is that of a cylindrical tube, rather flattened posteriorly, and diminishing in capacity as it descends.

It is composed of from fifteen to twenty segments of cartilaginous rings, incomplete posteriorly, the space being filled up by a musculo-membranous substance; in the expanded state of the trachea the cartilages form two thirds of a circle; when it is contracted or collapsed about three fourths. They are deepest in front, and differ from each other in depth and size; they are largest superiorly, thinner and nearer inferiorly, excepting the last, which is the deepest of all; they are united together by perpendicular ligamentous fibres.

The substance which completes the rings posteriorly is fibro-muscular. The fibres are connected transversely with the edges or ends of the cartilaginous rings; longitudinally, they descend from the cricoid cartilage to the bronchi. The lining mucous membrane of the trachea is continuous from the upper part of the larynx to the minutest ramifications of the bronchi. It is always moist, soft, and elastic; is thinner than in the larynx, and gradually more so as it passes into the ramifications of the bronchi.

The *bronchi* are formed by the bifurcation of the trachea, opposite the third dorsal vertebra.

The right bronchus is larger than the left, and is shorter, reaching the lung on a line with the fourth dorsal vertebra. It passes under the arch of the vena azygos, behind the vena cava superior.

The left bronchus passes under the arch of the aorta, accompanied by the left pulmonary artery and corresponding veins.

The structure of the bronchi is similar to that of the trachea. They divide and subdivide into numerous ramifications, till they appear to pass into a fine ligamentous tissue.

The *thyroid gland*, or more properly *body*, is situated on the front of the neck, beneath the sterno-hyoid and sterno-thyroid muscles, cervical fascia and integuments. It consists of two lateral lobes, connected in the middle by a portion of less depth, named the isthmus, which lies upon the third ring of the trachea; each lateral portion extends upwards to the side of the thyroid cartilage, and downwards as far as the fifth or sixth ring of the trachea. It is convex anteriorly, concave posteriorly; of a dusky-red colour; composed of a number of cells, containing generally a viscid fluid, and is very copiously supplied with blood-vessels from the superior and inferior thyroid arteries on each side, the former being from the external carotid, the latter from the subclavian; and sometimes an azygos branch in the centre, given off from the arch of the aorta. It has no excretory tube, and its exact use is unknown.

THORACIC VISCERA.

The *thorax* is a conical cavity, bounded superiorly by the first rib, the clavicle and soft parts entering and passing out of the chest; inferiorly by the diaphragm; anteriorly by the sternum and cartilages of the ribs; laterally by the bodies of the ribs and intercostal muscles; and posteriorly by the spine and the angles of the ribs.

The parts which pass through the upper aperture, are the trachea, thyroid veins, right and left carotid, subclavian, internal mammary and superior intercostal arteries, internal jugular and subclavian veins, the sterno-hyoid and sterno-thyroid muscles, nervus vagus, and recurrent nerve of the left side, the œsophagus, the cardiac and sympathetic nerves, and longus colli of each side, and the thoracic duct, besides some other parts of minor importance.

The contents of the thorax are the *lungs* and *pleuræ*, the *heart* and *pericardium*, and the contents of the *anterior* and *posterior mediastinum*.

The *pleura* of each side is a smooth serous membrane, forming a shut sac: one portion, lining the inside of the ribs, and the thickest, is called *pleura costalis*; the part reflected over the lungs is named *pleura pulmonalis*. It is also reflected upon the pericardium and diaphragm, on each side. By some anatomists a distinct fibrous membrane is described as existing between the ribs and the pleura.

The pleura is lubricated by a soft fluid or halitus; and the two portions are, during health, in constant apposition, solely with the intervention of this fluid.

These oval bags, by nearly meeting near the centre of the chest, form two triangular interstices, named the *anterior* and *posterior mediastinum*. Some anatomists add to these a third mediastinum, including within it the heart, pericardium, and phrenic nerves.

The *anterior mediastinum*, separated superiorly from the posterior one by the bifurcation of the trachea, the arch of the aorta and venæ innominatæ, contains the remains of the thymus gland, the origin of the sterno-hyoid and sterno-thyroid muscles, lymphatics from the surface of the liver, the left internal mammary artery and vein, and triangularis sterni muscle. Its base is formed by the sternum, its sides by the pleura of each side, and its apex by their approximation.

The *thymus* gland, scarcely perceptible in the adult, is of a considerable size in the fœtus and young child; it is first observable about the fourth month of fœtal life, increasing till birth; after which it remains stationary, or increases slightly till about the end of the first year, when it begins gradually to decrease. It consists of two elongated lobes, placed side by side in the anterior mediastinum. The structure of this body is like that of the thyroid; within it a cellular structure is observed, with sometimes a quantity of thick fluid. It is very vascular, but the use of it is unknown. Its supply of blood is from the internal mammary artery. It is a ductless gland.

The *posterior mediastinum* extends from the third to the tenth or eleventh dorsal vertebra. It contains the *æsophagus*, *aorta descendens*, the *thoracic duct*, the *par vagum* of each side, the *vena azygos*, some lymphatic glands and vessels, and the *splanchnic nerves;* but by some these nerves are considered to be a little beyond the boundaries of this mediastinum.

The *æsophagus*, inclined to the left side of the spine at the lower part, is most anterior, and is accompanied by the par vagum; the right par vagum is rather behind, but the left is in front; beneath or behind it is the aorta, a little on the left side of the spine. On the right is the vena azygos, and between these the thoracic duct.

The *lungs* are conical bodies, occupying the sides of the chest on each side of the mediastina. They are firmly attached to the heart by means of their large vessels, and to the trachea by the bronchi. The reflexion of the pleura, from the diaphragm of the lungs on either side, is named by some *pulmonary ligament* (*ligamentum latum pulmonum*).

They are invested by the pleura pulmonalis, which is more delicate than the membrane lining the ribs. The two layers of pleura are in close contact, having between them only a very minute portion of fluid to lubricate them in a healthy state, but no particle of air. If by accident or design an aperture is made into the bag of the pleura, the lung collapses from the atmospheric pressure, or more probably contracts, and the breathing becomes difficult and painful.

The colour of the lungs varies with the age. In the infant it is red; about twenty, it is bluish; and in more advanced age bluish-gray, with dark spots dispersed upon them.

The shape of the lungs is conical; the apex projects a little above the first rib; they are flattened anteriorly, convex posteriorly; the surface in contact with the pericardium is concave, particularly of the left lung; they are longest posteriorly, in the perpendicular direction.

The lungs posteriorly present an obtuse margin, anteriorly a thin margin, which is short and irregular. The anterior and inferior margin of each lung is very acute. There is a deep arched hollow in the lower margin of the left lung for the apex of the heart.

The right lung is largest, and slightly extends highest in the neck. It is divided into three lobes, but is shortest, in consequence of the situation of the liver.

The lungs have a spongy feel, and crepitate with the pressure of the fingers; they are composed of the bronchi, with their ramifications, terminating in air-cells, and lined by a mucous membrane, the pulmonary and bronchial arteries and veins, nerves, absorbents, and glands, connected together by cellular tissue, and invested by their general covering, the pleura.

On examining the minute structure of the lungs, we find them to be composed of a number of lobules connected together by interlobular cellular tissue. This cellular tissue is extremely delicate, often infiltrated with serum or air, as in emphysema; and gives passage to the minute lymphatic vessels.

The lobules do not communicate with each other. They are attached to the ramifications of the bronchi and vessels, like grapes to their stalk; and each lobule may be considered as a separate lung. They are not all distended with air, in ordinary inspiration, nor by the most powerful efforts that can be made. Those of the upper part of the lungs seem to be most filled, and are most constantly in action.

Each lobule is composed of a collection of air-cells, or vesicles, which communicate freely together; these cells vary in size, and always contain some air in the healthy state. The partition between them is imperfect, and is composed of very delicate cellular tissue. These cells consist of a thin fibrous tissue, lined with mucous membrane, and upon their walls the minute capillary branches of the pulmonary arteries and veins ramify.

The average quantity of the air which the lungs contain is not quite agreed upon; perhaps 200 cubic inches may be taken as the mean. This proportion will vary with the state of inspiration and expiration, as in each of those actions without effort, a change of about 30 cubic inches is supposed to take place. The carbonic acid evolved from the lungs in 24 hours has been estimated as much as 24,000 cubic inches, sufficient to afford 11 or 12 ounces of solid carbon.

The *pulmonary arteries,* unlike other arteries, carry venous blood for the purposes of the system generally. Their coats are slightly thinner than those of other arteries.

The *bronchial* arteries derived from the aorta are designed for the nutrition of the lungs.

The *pulmonary veins* carry arterial or decarbonized blood, and are firmer in their coats than veins in general. They are four in number, and terminate in the left auricle of the heart.

The lungs are supplied with nerves from the pulmonary plexuses, formed chiefly by the par vagum, together with filaments from the sympathetic.

The *absorbents* of the lungs are deep-seated and superficial. They pass to the bronchial glands at the roots of the lungs, and then proceed partly to the thoracic duct on the left side, and partly to a corresponding vessel on the right.

The *pericardium,* or investment of the heart, is formed by two membranes; the external one is fibrous, the inner one is serous, lining the fibrous coat, and reflected over the heart itself. It has also a partial covering from the pleura of each side, and is strengthened below by its attachment to the cordiform tendon of the diaphragm.

The fibrous bag of the pericardium is firmly attached to the central tendon of the diaphragm, inferiorly; laterally, with the pleura; and superiorly it is reflected upon the large vessels for some distance, and finally becomes continuous with their outer coat. It consists of fibres running in various directions, and is said to have eight openings in it, for the transmission of the large vessels, viz., one for the superior vena cava, two for the right and left branches of the pulmonary artery, one for the aorta, and four for the pulmonary veins. The vena cava inferior is immediately connected with the substance of the heart after its passage through the diaphragm, and it is said not to be surrounded by this fibrous coat. This statement appears very strange, if we admit that the fibrous bag surrounds the heart entirely; for in this case, the vein must either pass through the fibrous bag to the heart, or the heart must perforate the bag to reach the inferior vena cava.

The lining serous coat is a shut sac, containing a small quantity of thin fluid, for the purpose of lubricating it, and allowing the free motion of the heart in the pericardium.

THE HEART.

The *heart* is a hollow muscle, of rather a pyramidal figure, placed obliquely in the lower and front part of the thorax, and most inclined to the left side. It is convex above, rather flattened below, where it rests upon the diaphragm.

It is commonly described as externally divided into an apex, body, and base, a superior and inferior surface, and a right and left margin. The apex points between the cartilages of the fifth and sixth ribs of the left side. The base corresponds with the fourth and fifth dorsal vertebræ. The right margin is longest, but thinnest.

The heart physiologically may be considered as double; the right side, called *pulmonary*, to transmit the blood only to the lungs; the other *systemic*, from forcing the blood into all parts of the system. The right cavity of the heart is more capacious; the parietes of the left are considerably the thickest.

The substance of the heart is formed of its muscular portion, its investing and lining membrane, and its proper vessels and nerves.

The cavities of the heart are four: two at the base called auricles; and two at the apex, named ventricles.

When the pericardium is opened and the heart is *in situ*, the right side of the heart principally is brought into view; the parts seen are the right auricle and ventricle, the termination of the venæ cavæ, the appendix of the left auricle, the part of the left ventricle forming the apex of the heart, the root of the pulmonary artery and aorta, and the proper vessels of the heart, ramifying on its surface.

The *right auricle* of the heart may be divided into the large smooth portion, named *sinus venosus*, and the *auricula propria*.

The openings into the sinus are, one from the superior vena cava, one from the inferior vena cava, one from the coronary vein, and one into the right ventricle; and, according to some anatomists, little venous openings, termed *foramina Thebesii*. In the septum between this and the left auricle there is a depression named fossa ovalis, corresponding with the situation of the foramen ovale, surrounded by the *annulus fossæ ovalis*. There is frequently a slight valvular opening in the substance filling up the fossa.

A projection may be observed between the openings of the venæ cavæ, named *tuberculum Loweri*. From the upper margin of the inferior cava, a fold extends towards the annulus fossæ ovalis, named the *Eustachian valve*, less evident in the adult, but in the fœtus supposed to direct the blood from the inferior cava into the left auricle; between this and the auriculo-ventricular opening is the orifice of the coronary vein, with a valve partly covering it.

The *auricula propria*, or *appendix auriculæ*, communicates with the sinus venosus by a circular opening. It contains fleshy pillars, named *musculi pectinati*, which also extend in a thinner form over the anterior and upper surface of the sinus venosus. Some have supposed that the use of these fibres is to commingle the blood of the two cavæ, which is of a very different quality; that of the upper vessel containing the fluid poured into the circulation by the thoracic duct.

The *right ventricle* has two openings into it, the *auriculo-ventricular*, and an opening into the pulmonary artery.

It is of a triangular shape, the base being towards the right auricle, the apex near, but a little above the real apex of the heart; it is separated from the left ventricle by a thick partition, named septum cordis. The auriculo-ventricular opening is guarded by a fold of the lining membrane, named *tricuspid valve*, from presenting three triangular portions; of these one is anterior, another posterior, the third towards the left side, separating this opening from that of the pulmonary artery; this, the largest portion, has been named the *septum of Lieutaud;* at the attached base of this valve a ring of a tendinous nature is observed underneath the lining membrane; this is named the *zona tendinea*, and enters partly into the structure of the tricuspid valve, giving strength to it. A similar tendinous zone exists at the left auriculo-ventricular opening. These tendinous zones are the most fixed points of attachment for the muscular fibres of the heart. To the edges of the valve little tendinous strings are attached, named *chordæ tendinæ*, which, at their other extremity are connected with projecting muscular bundles, named *carnæ columnæ.* At the upper and anterior part, and to the extreme left, is the opening of the pulmonary artery, towards which the walls become smooth. This part is named *pars plana*, and, from an appearance of contracting towards the opening, is called *infundibulum*.

The carneæ-columnæ may be divided into three sets, one attached to the entire length of the wall of the ventricle, another attached at each end, with the centre free, the third attached at one end to the wall of the cavity, the other connected with the chordæ tendineæ, and these last are named by some anatomists *musuli papilliformes.*

The opening of the pulmonary artery is guarded by three *semilunar* or *sigmoid* folds, or valves, each of which, in the centre of its free margin, has a little granular body, called *corpus sesamoideum*, or *corpusculum Arantii.*

The pulmonary artery, passing upwards and backwards, nearly 2½ inches within the pericardium, divides into right and left branches. The right, which is the largest, passes under the arch of the aorta, and separates into three branches, which enter and ramify in the lungs. The left branch crosses over the descending aorta, and divides into two branches, which, like the right, divide and subdivide, terminating in capillary vessels, which reflected form the commencement of the four pulmonary veins.

The left auricle, situated at the upper and back part, like the right one, has a smooth portion, named *sinus arteriosus*, and an auricular appendix containing musculi pectinati, but is not so large as in the right side. There are five openings into it, four from the pulmonary veins, entering at its angles, and one into the left ventricle, rather smaller than on the right side. The fossa ovalis, with its annulus, may be perceived, but is not so evident as in the right auricle.

The left ventricle, of a conical form, has parietes much thicker than the right, and is longer, but its capacity for blood is rather smaller. Its extremity forms the apex of the heart; its inner wall forms the greater portion of the *septum ventriculorum*. It has an opening from the auricle, and one into the aorta. The auricular opening is surrounded or guarded by the *mitral* or *bicuspid valve*, which is strengthened by the *chordæ tendineæ*, and these are attached by their other extremity to the *carneæ columnæ*.

The mitral valve consists of two pieces, of which the right one is much the larger, and is placed between the opening from the auricle and that into the aorta, and is more deserving the name of septum than a similar portion of the tricuspid valve: its use is to divide the two currents of blood. At the upper part of the ventricle, and rather anterior to the auricular orifice, is the opening into the aorta.

The aorta and pulmonary artery are connected to the heart in a similar manner. The external and internal coats are continuous with those of the heart, but the middle elastic coat has a peculiar arrangement. It is found to commence by a defined edge, presenting three festoons, by which a few tendinous fibres connect it with the substance of the heart. At these openings, tendinous zones are described as existing, like those at the auriculo-ventricular openings, but are much weaker and less visible. At the commencement of the aorta there are three *sigmoid* or *semilunar* valves, with the corpora sesamoidea, as in the pulmonary artery. During the action of the left ventricle these valves are pressed back into three small hollows existing at the root of the aorta as well as of the pulmonary artery, and called the sinuses of Valsalva.

The structure of the muscular substance of the heart is very peculiar, and that of the ventricles is most deserving of attention. The ventricles appear to consist of two muscular bags, contained within a third, common to both.

All the muscular fibres take their origin from the tendinous zones, which may be observed between the junction of the auricles and ventricles, and also terminate in them. They are arranged in successive layers, but the fibres of them are in some measure blended with each other, so that it is impossible to assign to them any definite number.

The superficial fibres common to both ventricles are oblique and curvilinear, proceeding from the base towards the apex; those on the anterior surface pass from right to left, those on the posterior inferior surface in an opposite direction. These fibres do not terminate at the apex, but are matted together, and reflected back towards the base again. Some of the superficial fibres at the apex of the heart are curved and turned inwards, forming reflected fibres, which constitute the fleshy pillars of the heart.

The proper fibres of each ventricle are placed between the superficial and deep fibres of the common muscular coat, in the form of a cone, and resting against each other, with a superior large opening, viz., auricular and an inferior small one, which gives passage to the deep fibres. They proceed from the tendinous zone, in a spiral manner from the base to the apex and back again. The common reflected deep fibres pass in, as just mentioned, and diverge in a radiating manner, and are distributed in three modes: some pass to the opposite wall of the interior of the ventricle, others run along the inside of the same wall, and a third set forms the carneæ columnæ. The muscular fibres of the auricles are also of two kinds, proper and common; the latter run in a transverse direction; the proper fibres are thin, and take their origin from the auriculo-ventricular zone, and also return to it. Some of them run obliquely, others perpendicularly, and are more developed on the left than right auricle.

The first arteries given off from the aorta are the right and left *coronary*, for the supply of the heart itself. These vessels are sent off before the pericardium quits the aorta, and receive their blood in a different manner from all other arteries in the body, for the blood enters them by regurgitation, and flows in a retrograde direction.

The *right coronary* artery passes along the right border of the pulmonary artery, then transversely in the groove between the right auricle and right ventricle, to the under surface of the heart, as far as the septum, where it divides into two branches; one runs in the groove between the left auricle and ventricle, anastomosing with the left coronary, the other descends between the two ventricles as far as the apex of the heart.

The *left coronary* artery, smaller than the right, comes off from the aorta, a little higher up, and is first observed between the pulmonary artery and left auricle; when it arrives at the septum ventriculorum, it divides into two branches; one takes a transverse course to the left, running in the groove between the left auricle and ventricle, anastomosing with the right coronary; the other runs down on the upper surface of the heart, along the septum of the ventricles as far as the apex. From these vessels minute branches pass into the several parts of the heart, and supply the roots of the large vessels.

The arteries from the arch of the aorta are—

The *arteria innominata*, which divides into right carotid and right subclavian.
The *left carotid*.
The *left subclavian*.

The common carotid divides into external and internal.

The branches from the external carotid are—

Anteriorly,	Superior thyroid. Lingual. Labial.
Posteriorly,	Muscular. Occipital. Posterior aural.
Ascending,	Pharyngeal.
Terminating,	Temporal. Internal maxillary. Transverse facial.

The branches of the internal carotid within the cranium are—

Ophthalmic.	*Middle cerebral.*
Anterior cerebral.	*Posterior communicating.*

The branches of the subclavian are—

Vertebral.
Internal mammary.
Thyroid axis,
  Inferior thyroid.
  Ascending cervical.
  Supra scapular.
  Posterior scapular.
Cervicalis profunda.
Intercostalis superior.

The thoracic aorta gives off—

Bronchial arteries, to nourish the lungs.
Œsophageal.
Intercostal, to the pleura, intercostal muscles, and spine.

THE BRANCHES OF THE ABDOMINAL AORTA.

The *phrenic* arteries arise from the anterior part of the aorta, sometimes by a single trunk, whilst it is between the crura of the diaphragm. They spread out immediately after their origin to supply the diaphragm, which they pierce in many places to inosculate with the branches which ramify on its superior surface. They frequently give a twig to the suprarenal capsules.

The *cœliac axis* arises immediately beneath the phrenic arteries. It is a short thick trunk, about half an inch in length, and divides into three branches—the *gastric*, or *coronaria ventriculi*, the *hepatic*, and *splenic*.

The *coronaria ventriculi*, the smallest of the three, runs in the left border of the lesser omentum to the cardiac orifice of the stomach, which it supplies, and sends a branch to run along the lesser curvature from left to right, and anastomose with the pyloric arteries.

The *hepatic* artery runs forwards and upwards in the lesser omentum to the liver, previously to reaching which it gives off the following branches :

a. The *superior pyloric*, which is distributed to the pyloric extremity of the stomach.

b. The *gastro-duodenalis* first gives off the inferior pyloric, and then divides behind the pylorus into two branches—the *gastro-epiploica dextra*, which runs along the greater curvature of the stomach (in the omentum) from right to left, and the *pancreatico-duodenalis*, which runs round the head of the pancreas, between it and the duodenum, giving branches to both.

The main trunk of the hepatic artery divides into two branches, which are distributed to the right and left lobes of the liver. From the former is given off the *cystic* branch, which supplies the gall bladder.

The *splenic*, the largest artery derived from the cœliac axis, runs from right to left along the upper and posterior portion of the pancreas, and terminates in several large branches, which enter the spleen at its hilum. In its course, the splenic gives off several small branches to the pancreas, called *pancreaticæ parvæ*, as well as one larger, which, piercing the pancreas, runs in its interior from left to right, called the *pancreatica magna*. Just before its termination it gives off several branches, which turn back to the stomach. One of these, the gastro-epiploica sinistra, runs along the greater curvature from left to right; the remainder, called vasa-brevia, run to the great cul-de-sac, on which they are distributed.

About an inch below the cœliac axis arises the *superior mesenteric artery*, the largest branch from the aorta. It passes between the pancreas and duodenum (the former being superior), and finally divides into branches in the mesentery. The trunk of this artery forms a sort of arch (from the root of the mesentery to the right iliac fossa), the convexity of which is directed to the left side. From the convexity are given off about nineteen branches, called *rami mesenterici*, which by repeatedly dividing and subdividing, enter the small intestines as extremely minute twigs. From the concavity of the arch are given off the three following: the *ilio-colic*, which supplies the lower portion of ilium and cæcum; the *colica dextra*, which supplies the ascending; and the *colica media*, which supplies the transverse colon.

From the aorta on either side of the superior mesenteric, arise the *capsular* or *suprarenal* arteries. They are very small.

Immediately beneath these last arise the emulgent, or *renal* arteries. These are of large size, and are remarkable from their being given off at right angles to the main trunk. The right is a little longer than the left.

The *spermatic* arteries arise still lower down from a more anterior part of the aorta, sometimes from a common trunk. They pass downwards, forwards, and outwards along the psoas muscles, and finally join the rest of the spermatic cord to pass to the testicles. They are the longest arteries in the body without a branch.

The *inferior mesenteric* artery arises from the anterior part of the aorta, about two inches before its termination. It passes downwards, outwards, and to the left side, and divides in the left iliac fossa into its three terminating branches—the *colica sinistra*, which supplies the descending colon, the *sigmoid* branch, which supplies the sigmoid flexure, and the *superior hæmorrhoidal*, which goes to the upper part of the rectum.

The lumbar, five in number on each side, supply the parietes of the abdomen in the same way as the intercostals do those of the chest.

The abdominal aorta terminates by dividing into the two common iliac arteries, and giving off at its bifurcation the arteria sacra media.

The *sacra media* artery descends perpendicularly in front of the sacrum, and gives branches to the rectum, as well as some which pass through the sacral foramina, and others which inosculate with the lateral sacral arteries.

The *common iliac* artery of each side passes outwards and downwards, to divide opposite the sacro-iliac synchondrosis into the external and internal iliac arteries. The common iliac gives off no branches in its course.

The *external iliac* artery runs downwards, forwards, and outwards, resting slightly upon the psoas muscle to pass under Poupart's ligament, where it becomes femoral. The only branches it gives off are—

a. The *deep epigastric*, which arises from the external iliac just before it passes under Poupart's ligament. This branch runs upwards and inwards, at first between the peritoneum and transversalis fascia, and afterwards within the sheath of the rectus, to terminate by inosculating with the internal mammary artery.

b. The *deep circumflexa ilii.* This artery takes its course along the crest of the ilium to supply the parts in its immediate neighbourhood, running partly within the iliacus internus, and partly between the internal oblique and transversalis muscles.

The branches of the internal iliac are, in the female—

Sacra lateralis, running down the sides of the sacrum.
Iliolumbalis, distributed to the muscles.
Uterine, to the uterus and its appendages.
Middle hæmorrhoidal, to the middle portion of the rectum.
Vesical, to the bladder.
Vaginal, to the upper part of the vagina.
Hypogastric, this is the remains of the umbilical artery of the fœtus, and forms the superior vesical artery.
Gluteal, supplying the muscles.
Ischiatic, supplying the neighbouring muscles and the sciatic nerve.
Obturator, distributed to the muscles of the thigh and hip-joint.
Pudic, internal. This gives off the following branches, whose function is known by their name: the external hæmorrhoidal; the superficial and transverse perinæal arteries, in both sexes; the artery of the bulb; the artery of the corpus cavernosum; and the arteria dorsalis penis in the male.

The same arteries exist in the male, excepting the uterine and vaginal.

The principal *coats* of an artery are *three* in number: an external or fibro-cellular coat, a middle fibrous or muscular coat, which is thick, yellow, and elastic. By means of this coat the arteries remain patulous after death. The third, or inner coat, is thin and transparent, resembling a serous membrane. It is a continuation of the lining membrane of the heart.

The coats of the veins are the same in number, but much thinner. The serous coat of the veins is, however, internally thrown into folds which form the valves.

The coats of the arteries receive their vessels (vasa vasorum) from the neighbouring arteries, and are abundantly supplied with nerves from the cerebral, spinal, and sympathetic nerves.

The veins in general accompany the arteries, and receive their names accordingly; the principal exception is the vena azygos.

The *vena azygos* commences by two or three lumbar veins, then passes through the diaphragm, ascends in the chest on the right side of the spine, receiving the right intercostal, bronchial, and œsophageal, and the five or six lower left intercostal veins; after receiving these vessels it winds round the right bronchus, and ends in the superior vena cava, just before it enters the pericardium.

The superior left intercostal veins, with the left bronchial and œsophageal, form the *superior intercostal vein* (Quain), or *azygos minor superior*, which terminates in the left vena innominata, or crosses over the spine to unite with the vena azygos.

The five or six lower left intercostal veins generally unite into one vessel, which is named by some anatomists *azygos minor inferior*. It generally crosses the spine to pass into the vena azygos.

The *thoracic duct* commences at the third lumbar vertebra, by an enlarged extremity, termed receptaculum chyli; it passes up through the aortic opening of the diaphragm, between the aorta and vena azygos; rather above these it quits the mesial line, and runs up behind the aorta, ascends in the neck as high as the sixth cervical vertebra, curves downwards, and terminates in the angle formed by the left subclavian and internal jugular veins. It receives the chyle as well as the lymph from the inferior extremities, the left upper extremity, the left side of the head and neck, and the left lung. There is a corresponding duct, but of much smaller size, on the right side. This receives the lymph only from the right side of the head and neck, the right lung, the right upper extremity, and the surfaee of the liver. It is called the *ductus lymphaticus dexter*, or *thoracicus minor*.

ABDOMEN.

The abdomen is separated from the chest by the *diaphragm*, which is a broad flat expanded muscle, the largest of the body. It is best described as consisting of two muscles and a central tendon. The large muscle arises from the ensiform cartilage, the inside of the cartilages of the six lower ribs, and the true and false ligamenta arcuata; from which points the fibres converge, and are inserted into the central tendon.

The small muscle consists of the crura, which arise on the right side from the fore parts of the bodies of the four upper lumbar vertebra, and on the left, from the sides of the three upper lumbar vertebra; from these points the fibres ascend, some of them crossing over and decussating to surround the œsophageal opening, but all are ultimately inserted into the central tendon.

The cordiform tendon, as its name implies, is somewhat heart-shaped or triangular, and is stated to resemble a trefoil leaf. Above the diaphragm we find the pleura and pericardium, below it the peritoneum. The openings in the diaphragm are three large and some minor ones. The large openings are for the vena cava, œsophagus, and aorta.

The opening of the vena cava is quadrangular in form, most anterior, and to the right side, is situated in the tendon of the diaphragm, passing through this part in order that the column of blood should not be pressed upon when the diaphragm contracts. Besides the vena cava, we find passing through it some filaments for the right phrenic nerve, which go to the surface of the liver, and which best explain the pain felt in the right shoulder in hepatitis.

The *aortic* opening most posterior, triangular, and between the crura, transmits the aorta, vena azygos, and thoracic duct, and sometimes one of the splanchnic nerves.

The *œsophageal* opening is truly muscular, anterior to the aortic, and a little more inclined to the left. It transmits, in addition to the œsophagus, the right and left par vagum, and an ascending branch from the coronaria ventriculi artery. The smaller openings are for the internal mammary arteries, splanchnic nerves, and the superficial absorbents of the liver.

The diaphragm is supplied by the phrenic nerves, and with phrenic arteries from the abdominal aorta.

Use of the diaphragm.—One of the principal agents in inspiration; it is used in vomiting, the expulsion of the fæces, fœtus, and urine; and is engaged in sighing, sneezing, and many other affections of the respiratory apparatus.

The *abdomen*, the largest cavity in the body, extends from the diaphragm to the pelvis, which form its superior and inferior boundaries. It is bounded anteriorly and laterally by the abdominal muscles and parietes, and posteriorly by the spine, the quadratus lumborum, and psoæ muscles.

The coverings of the abdomen are, the cuticle, rete mucosum, cutis vera, adipose tissue, cellular tissue (here named fascia superficialis), the muscles with their tendinous expansions, facia transversalis, and peritoneum.

MUSCLES OF THE ABDOMEN.

The abdominal muscles consist of five pairs, viz., obliqui externi, obliqui interni, transversales, recti, and pyramidales; the last are sometimes absent.

OBLIQUUS EXTERNUS *vel* DESCENDENS. *Or.* By fleshy slips from the external surfaces of the eight or nine inferior ribs at a little distance from their cartilages.

Ins. Ensiform cartilage, linea alba, os pubis, Poupart's ligament, into the anterior superior spinous process of the ilium, and the outer edge of anterior half of the crista ilii.

OBLIQUUS INTERNUS *vel* ASCENDENS. *Or.* Fascia lumborum, nearly all the crista ilii, and the external third or fourth of Poupart's ligament.

Ins. Cartilages of six inferior ribs, ensiform cartilage, the linea alba, also by the conjoined tendons into the symphysis and upper edge of pubis, and into the linea ileo-pectinea.

CREMASTER. This muscle, deriving part of its origin from the internal oblique, is here described, though only a muscle elevating the testicle. *Or.* Inner surface of the external third of Poupart's ligament, and from the lower edge of the obliquus internus, and sometimes from the transversalis. It often has an attachment to the pubis.

Ins. Tunica vaginalis and scrotum.

TRANSVERSALIS. *Or.* Fascia lumborum, internal lip of the crista ilii, the iliac third of Poupart's ligament, and the inner side of the cartilages of the six inferior ribs.

Ins. Along with the posterior lamina of obliquus internus, into the ensiform, cartilage whole length of the linea alba, and the symphysis pubis.

RECTUS. *Or.* Upper and anterior part of pubis.

Ins. Ensiform cartilage, the costo-xiphoid ligament, and the cartilages of the sixth and seventh ribs.

PYRAMIDALIS. *Or.* Broad from the pubis.

Ins. Linea alba, midway to umbilicus; it is sometimes wanting.

Anatomists divide the abdomen, externally, by transverse or circular lines, into three regions: first, a line is drawn round the body, on a level with the cartilage of the ninth rib, and forms the lower boundary of the epigastric region; another line is drawn across on a level with the crista of each ilium, forming a limit between the umbilical and hypogastric regions; a perpendicular line may then be made on each side, from the edge of the eighth rib, to intersect the centre of Poupart's ligament. By this arrangement, the superior zone, or epigastric region, is subdivided into the right and left hypochondrium and proper epigastrium, or scrobiculus cordis. The central zone is separated into the right and left lumbar and proper umbilical region, and the lower portion is partitioned into the right and left iliac, and hypogastric or pubic regions.

The abdomen contains the alimentary canal and its appendages, and part of the urinary, and a portion of the genital organs during pregnancy.

The alimentary canal in the abdomen comprises the *stomach*, the *small* and *large intestines*.

The appendages are the *liver*, with the *gall-bladder*, the *spleen* and *pancreas*.

The urinary organs are the *kidneys*, the *ureters*, and part of the *bladder*, when distended.

The genital organs in the abdomen are restricted to the female, and only strictly so in the impregnated state. They are the *uterus*, *Fallopian tubes*, and *ovaries*.

When the abdomen is opened in the usual manner, the parts brought into view are the following: a small portion of the anterior and inferior part of the liver, the fundus of the gall-bladder, a portion of the stomach, and the great omentum, laterally, portions of the colon. If the omentum be raised, the small intestines and transverse colon may be seen, and part of the bladder if it be distended.

The *peritoneum* is an elastic serous membrane, lining the cavity of the abdomen, and investing the various viscera, giving them strength and support. Its reflexions from one viscus to another form duplicatures, which receive different names, according to their situation. The reflexion of the peritoneum, from the diaphragm to the liver, forms the ligaments of the liver; that from the liver to the stomach forms the lesser omentum; from the stomach to the transverse colon forms the great omentum; the portion enclosing the colon forms the mesocolon; that which extends down and over the small intestines is called the mesentery. There are, besides these, the ligaments of the bladder, uterus, and rectum, and also the appendices epiploicæ, which are formed by it. In the male the peritoneum is a perfectly shut sac; but in the female there is an opening into it on each side from the Fallopian tube, the only instance in the body in which a mucous and serous membrane communicate. It must be borne in mind that all the viscera are external to the peritoneum.

Reflexions of the Peritoneum.—Tracing the peritoneum upwards from the abdominal muscles, it lines the under surface of the diaphragm, passes on to the liver (forming its ligaments), and at its concave parts meets a layer coming from the pillars of the diaphragm and under surface of the stomach. The two layers pass forwards to the small curvature of the stomach, forming the lesser omentum, cover the stomach, meet at the great curvatures, and hang down in folds over the intestines; they then ascend and embrace the colon, meet again, forming the mesocolon, and again separate. The lower layer passes down, is reflected from the spine to the small intestines, surrounds them, and returns to the spine, forming the mesentery, then descends laterally over the kidneys, part of the rectum, mounts up towards the bladder and uterus, and ascends upon the abdominal parieties. The ascending layer of the mesocolon goes over the pancreas, duodenum, and crura of the diaphragm, and rises to meet the other portion at the under surface of the liver.

This portion of the peritoneum lines a space, called the bag of the omentum, which has not a very free communication with the rest of the abdominal cavity. The only opening into it, is behind the rounded edge of the lesser omentum, which contains the large hepatic vessels, and is by some called Glisson's capsule. The passage is named the *foramen of Winslow;* and its boundaries are as follow:

Anteriorly, the lesser omentum and hepatic vessels.
Posteriorly, the ascending layer of the transverse mesocolon.
Superiorly, lobulus caudatus of the liver.
Inferiorly, the superior portion of the duodenum.

The *stomach* is a musculo-membranous bag, interposed between the œsophagus and duodenum. It is situated in the left hypochondrium, under the left false ribs, extends across the epigastric region, and terminates on reaching the right hypochondrium.

The parts in relation with it are:—

Above and in front,	the liver, diaphragm, and ribs.
Inferiorly,	the colon and mesocolon.
Posteriorly,	the pancreas, spleen, and left supra-renal capsule.
At its right extremity,	the duodenum, liver, and gall-bladder.

There are two openings into it, the *cardiac* or *œsophageal,* and *pyloric.* The former is most posterior and superior, so that the stomach inclines obliquely forwards and downwards.

There are two surfaces, an anterior and posterior, in the ordinary state; but when the stomach is distended, the anterior becomes superior, and the posterior inferior; the lesser arch is carried further backwards, and the greater more forwards, extending even into the umbilical region. In this state of the stomach, its right extremity is in close contact with the gall-bladder.

The stomach in its figure resembles a curved or oblong cone; it is largest at its œsophageal end; the left third beyond the œsophagus is called the cul-de-sac of the stomach, which in the child scarcely exists, and which affords an explanation why they vomit with so much facility.

The pyloric orifice is even smaller than the commencement of the duodenum. It is so situate as in a great measure to form an acute angle with the œsophagus.

The stomach is kept in its situation by its union with the œsophagus and duodenum, by the lesser and greater omentum, by the splenic omentum, and by the peritoneum attaching it to the diaphragm.

The stomach is formed of three coats, a *peritoneal, muscular,* and *mucous,* connected together by cellular tissue.

The *peritoneal coat* is external; it is a continuation of the small and great omentum, smooth and shining, attached by its rough surface to the muscular coat. It does not cover the stomach directly along either curvature where the arteries pass.

The *muscular coat* consists of three series of fibres, longitudinal, circular, and oblique.

The *longitudinal* or *external fibres* are continued from the œsophagus: they spread out upon the surface of the stomach. The external fibres are wider and more diffused than the internal ones, and are more evident along the curvatures.

The oblique or *transverse fibres* form the deepest layer: they surround the stomach obliquely, often crossing each other, and are most abundant about the cul-de-sac.

The *circular fibres*, continued from the œsophagus, are most evident at the right end of the stomach; in the centre they are somewhat less strong, and give an hour-glass appearance to the stomach. At the pylorus they are most developed, and form, as it were, a sphincter to it.

The *lining* or *mucous coat* is corrugated, soft, and of a reddish colour. It is always moist, and lubricated by a tolerably thick mucus. The *rugæ* run in different directions; those near the œsophagus have a radiated appearance; others, and the most constant, run longitudinally from the great end to the pylorus, connected by lateral prominences. These almost disappear when the stomach is much distended. A distinct loose fold of it assists in the formation of the pylorus.

The membrane, minutely inspected, presents an immense number of small prominences, which give the villous appearance. They appear to be composed of a delicate network of vessels, with perhaps orifices of absorbent vessels.

The stomach is supplied with mucous follicles, situated between the rugæ, and these have been named gastric follicles; they are most numerous at the œsophageal end, and along the curvatures. Opening into these follicles are numerous tubuli, lined with columnar and spheroidal epithelium. Some believe these to be organs for the secretion of gastric juice.

The arterial branches for the supply of the stomach are all from the cœliac axis. They are, the *coronaria ventriculi* or *superior gastric*, distributed to the smaller curvature; the *superior* and *inferior pyloric*, to its pyloric end; the *vasa brevia*, to the great cul-de-sac and the *gastro-epiploica sinistra* and *dextra*, to the larger curvature.

Its nerves are chiefly from the par vagum, with some filaments from the sympathetic and phrenic.

Its veins pass chiefly into the splenic vein, and its absorbents into the thoracic duct.

The *intestines* are divided into small and large. The length of the human intestinal canal is about six times greater than that of the trunk; and is still longer in proportion in graminivorous animals.

The small intestines are the *duodenum*, *jejunum*, and *ilium*. In length they form about two thirds of the intestinal canal.

The small intestines, as also the large, have the same coats as the stomach, but with some exceptions, in relation to the peritoneum. These coats are generally stated to be three. The muscular coat consists of two series of fibres, longitudinal outside, circular inside. The mucous or villous coat, which is much the largest in the small intestines, is arranged in folds, named valvulæ conniventes, to afford a larger surface for absorption, and to cause some retardation in the passage of the chyle. This coat is studded with mucous follicles; those of the duodenum are named glandulæ Brunneri; those in the jejunum and ileum, glandulæ aggregatæ or Peyeri; besides these there exist numerous other small glands forming the solitary glands, and the follicles of Lieberkühn.

The first portion, the *duodenum*, so named from its length being equal to the breadth of twelve fingers, *i. e.*, from eight to nine inches, commences at the pyloric end of the stomach.

It is rather broader than the other small intestines, and from a supposed marvellous distensibility, has been named *ventriculus succenturiatus*.

It is also imagined that it is less covered by peritoneum, in order that this distension may be more easily accomplished.

The duodenum first inclines upwards, backwards, and to the right, and having arrived near the neck of the gall-bladder, it bends vertically downwards, and again changes to a transverse direction, thus forming two curves or angles. Hence it is convex to the right, concave internally and to the left; and is divided into three portions.

The *first* portion of the duodenum is in immediate relation with the liver and neck of the gall-bladder, posteriorly with the hepatic vessels and omentum, and is almost surrounded by peritoneum. Its length is about two inches. In this portion Brunner's glands are not numerous. They are small racemose glands, and have a excreting duct.

The *second* portion, perpendicular, has—

In front and externally.	the ascending colon.
Behind,	the concave portion of the right kidney.
Internally.	the pancreas.

This part is from two to three inches long; at the lower part of its posterior surface is the opening from the ductus communis choledochus and pancreatic duct; it is only covered anteriorly by peritoneum.

The *third* portion, transverse, is covered anteriorly by the mesocolon.

Bounded above,	by the pancreas,
Anteriorly,	by the stomach,
And posteriorly,	by the vena cava, aorta, and crura of the diaphragm.

The regions occupied by the duodenum are the right hypochondrium, the right lumbar slightly, and finally, the junction of the proper epigastric and umbilical regions.

It is distinguished from the jejunum and ilium by being shorter, more partially covered by peritoneum, confined to its position, and by having more openings into it.

The *ductus communis choledochus*, after passing some way between the muscular and mucous coats, opens into the duodenum, near the junction of the second and third portions, and sometimes by a common orifice with the pancreatic duct. It occasionally enters as high up as the superior curve or angle, at a distance of two or three inches from the pylorus. The arteries of the duodenum are from the hepatic and superior mesenteric. In this intestine chylification takes place.

The rest of the small intestines consist of the jejunum and ilium.

The upper two fifths of this portion of the intestines are called *jejunum*, and the lower three fifths *ilium*.

The *jejunum*, so named from being generally found empty, terminates in the ilium, and closely resembles it in its structure.

The distinctive characters of the *jejunum* from the ilium are, its coats are thicker, it is of a redder colour, has more valvulæ conniventes, and consequently a greater surface for absorption.

The jejunum and ilium occupy, in part, the umbilical region, parts of the lumbar, iliac, and hypogastric regions, and in some measure rest in the pelvis of the adult. They are covered anteriorly by the great omentum, and surrounded by the arch of the colon.

In the lower part of the ilium there is a large number of glands or follicles, named Peyer's glands, collected into clusters, hence named glandulæ aggregatæ; they occupy the convex surface of the intestine, most distant from the mesentery. In typhus fever and phthisis they are often found inflamed and ulcerated.

The jejunum and ilium are supplied with blood by the superior mesenteric artery.

The large intestines commence at the termination of the ilium in the right iliac fossa; they are the *cæcum*, *colon*, and *rectum*. They have the same coats as the small intestines; but thinner. Their length is from three feet and a half to four feet, forming about a fifth of the intestinal tube.

The large intestines, *i. e.*, the cæcum and colon, are particularly characterised by their sacculated appearance, occasioned by the longitudinal fibres being somewhat shortened and gathered into bands, and differ from the small intestines in being wider, shorter, and straighter, and by having the appendices epiploicæ attached to them.

The *cæcum*, or *caput coli*, is the first portion; it commences from the ilium, and is situated beneath the right kidney, resting in the right iliac fossa.

It is bounded in front by the abdominal parietes; behind, by the iliacus muscle; internally has the ilium opening into it. It is generally covered by peritoneum on its anterior surface only, but sometimes is surrounded by it like the colon; and may then be said to be attached by a meso-cæcum.

At the junction of the cæcum and colon with the ilium, the lining membrane, with circular muscular fibres, forms folds, called *ilio-cæcal* and *ilio-colic valves*.

These valves present each a concave border, looking upwards and towards the right. The ilio-colic portion is horizontal; the ilio-cæcal nearly perpendicular; they are united at each extremity, and if either of them be pressed against, the opening between them becomes almost perfectly closed.

There is a little worm-like appendage attached to the cæcum at its under and back part, called *appendix vermiformis;* it is rudimentary of a much larger part developed in animals.

It varies in length from one to six inches, and is ordinarily of the size of a goose-quill. Its precise position is very uncertain, although it more frequently projects or hangs down over the border of the pelvis. Its cavity is small, ending in a cul-de-sac, and contains a little mucus. Its structure is like that of the large intestines. The use of this body is unknown.

The colon is divided into four portions: the *ascending*, the *transverse*, the *descending*, and its *sigmoid flexure*, which terminates in the rectum, opposite the left sacro-iliac synchondrosis.

Little folds of peritoneum, containing fat, hang down from the colon, called *appendices epiploicæ*.

The ascending colon passes up on the right side, bounded—

In front,	by the abdominal parietes.
Behind,	by the quadratus lumborum and right kidney.
Above,	by the margin of the liver.

The transverse colon extends from the right to the left hypochondrium, along the junction of the epigastric, with the umbilical region; on the right side it touches the gall-bladder, on the left it is just below the spleen; it is kept in its place by the transverse mesocolon; thus, above it, we find the liver, which is sometimes slightly grooved for it, the gall-bladder, the stomach, and lower part of the spleen. Below the transverse colon there are only the small intestines. It is almost entirely covered by peritoneum.

The left lumbar, or descending colon, is bounded in a very similar manner to the right, as to the parietes and small intestines, only reversing the sides; its calibre is rather less, and at the upper part it is deeper seated. It is but slightly covered by peritoneum.

The *sigmoid* flexure of the colon is situated in the left iliac fossa. It is connected by a rather loose fold of peritoneum, which allows it a considerable degree of motion, and, from its curved form, is supposed to be intended for a partial reservoir of fæcal matter. It is bounded in front by the abdominal parietes; behind, by the iliacus muscle, on which it rests; internally, it is in relation with the small intestines. It is capable of considerable distension, and is the great reservoir of the fæces in most persons.

The longitudinal bands, which are three on the ascending and transverse colon, often merge into two in the descending and sigmoid portions, and the sacculi are frequently less developed.

The *rectum* commences at the sigmoid flexure of the colon, and terminates in the anus.

Arising from the left side, it immediately inclines to the mesial line, follows the curve of the sacrum, and terminates at about an inch beyond and before the coccyx; from this bone it turns a little backwards, and is thus removed from the vagina of the female and urethra of the male.

It is. cylindrical in shape, and not sacculated like the colon, in consequence of the longitudinal fibres being dispersed over it uniformly; it is narrowest at its upper part, and becomes gradually dilated till it arrives near the anus, just above which the dilatation is considerable, like a large reservoir, which sometimes is enormously distended with fæces.

Boundaries and relations.—Behind it, first, there is the sacro-iliac symphysis, then the curvature of the sacrum and coccyx; superiorly, it is attached to the sacrum by a fold of peritoneum, named mesorectum, and is separated from the symphysis and sacrum by the pyriformis muscle, the sacral plexus, and hypogastric vessels. In the portion beyond the coccyx, the levator and sphincter ani form a kind of floor for it.

In front, the rectum is free at its upper part, but adherent in the lower portion; and, as its relations vary with the sex, they must be spoken of separately.

In the male the upper part looks towards the posterior wall of the bladder, from which it is separated by some convolutions of the small intestines; at its adherent portion, lower down, it is in relation with the bas-fond, or lower fundus of the bladder, where the trigone is situated, and which thus rests upon the rectum. The peritoneum sometimes descends so as to cover this part, and may even extend as far as the prostate gland, forming a cul-de-sac lower than usual; further down the rectum is in close contact with the prostate gland, and still further has some relation to the urethra, but is separated from it by a triangular space, the base of which is forwards and downwards, the apex upwards and backwards.

In the female, the free portion of the rectum is in apposition with the broad ligament, Fallopian tube, and ovary of the left side, the uterus, and the vagina. Between these parts and the rectum there is a cul-de-sac of peritoneum, as in the male between the rectum and bladder; in this part, when the rectum and uterus are comparatively empty, there are some convolutions of the small intestines. In the lower part, the rectum is in immediate connexion with the vagina, to which it is very adherent; but as it descends still lower it quits the vagina as it turns backwards, and leaves a perineal triangular space, analogous to that in the male. On its sides, the free part of the rectum has convolutions of the small intestines, but lower down a large quantity of loose cellular tissue containing a considerable quantity of fat.

The inside of the rectum presents a number of longitudinal folds, like those of the œsophagus; and these are intersected by a few semicircular ones. The longitudinal folds have been named the pillars of the rectum.

The cæcum and part of the colon are supplied with blood from the superior mesenteric artery; the rest of the colon and upper part of the rectum, from the inferior mesenteric; the rest of the rectum receives blood from the internal iliac and internal pudic artery. The rectum is one of the most vascular parts of the intestinal canal.

The veins of the intestines terminate in the *vena portæ.*

The nerves are supplied chiefly from the *great sympathetic.*

The rectum alone is supplied with nerves, both from the ganglionic and cerebro-spinal system. This is necessitated by the functions of this intestine, which is partly under the influence of the will, and partly independent of it.

The *liver* is a conglomerate gland, the largest of the body, from three to four pounds in weight; it is situated in the right hypochondrium, epigastrium, and part of the left hypochondrium. It is superiorly and anteriorly convex, inferiorly and posteriorly concave. Its right margin is rounded, whilst its left comes to a point. It is divided, for the sake of description, into a right and left lobe; on the under surface of the right or large lobe anatomists describe three divisions or lobes, with the names *lobulus Spigelii, lobulus caudatus,* and *lobulus quadratus.* The latter is the quadrangular portion, bounded by the gall-bladder to the right, the transverse fissure behind, fossa umbilicalis to the left, and acute margin of the liver in front and below. The lobulus Spigelii is behind the transverse fissure, between the vena cava inferior, and fossa ductus venosi.

The *liver* is kept in its place by five ligaments, which are named the *broad,* the *round,* the *right* and *left lateral,* and the *coronary* ligament.

These ligaments are formed by the peritoneum, excepting the round ligament, which consists of the remains of the umbilical vein.

The liver has two coats, the peritoneal and tunica propria, of cellulo-fibrous structure, which also surrounds the different vessels, and accompanies them to their minutest ramifications, thus forming the real capsule of Glisson of Mr. Kiernan. There are five fissures, or depressions of the liver, viz., the *great* or *longitudinal fissure,* which may be divided into two parts—the anterior half, named *fossa umbilicalis,* giving lodgment to part of the round ligament in the adult, and to the umbilical vein in the fœtus; the posterior half, named *fossa ductûs venosi,* from its function during fœtal life; the *fissure* for the *vena portæ,* named sulcus transversus, or sinus venæ portarum, through which pass the great vessels, nerves, biliary ducts, and absorbents; that for the *vena cava,* and the depression for the *gall-bladder.*

There are also several depressions of the liver mentioned, but they are generally very indistinct; there is one for the stomach, one for the colon, and one for the right kidney, and a groove for the œsophagus.

The liver may be considered as a collection of little livers, or acini, now designated lobules by Mr. Kiernan, which are composed of *ramifications of blood-vessels, absorbents, biliary ducts,* and *nerves,* connected together by cellular substance.

The minute structure of the liver has been investigated by Mr. Kiernan, one of the most skilful anatomists of the present age. The results of his observations have the following purport:

He first commences by stating that the liver has three surfaces, viz., the commonly received surface, the portal surface, and the hepatico-venous; the two latter are such as would be exposed by mechanically separating the lobules of the liver from the branches of these vessels.

The ramifications of the venæ hepaticæ resemble a tree with its branches, upon which the lobules are placed.

The *lobules* have somewhat an hexangular form, connected together by a delicate cellular tissue, but presenting between each other interlobular spaces, which lodge the interlobular veins.

The interlobular veins are the minute ramifications of the vena portæ, after it has received the small branches of the hepatic artery. These interlobular veins send into each lobule, from its circumference to its centre, minute branches, which conjointly form the lobular venous plexuses; these minute branches terminate in biliary pores, and in reflected minute vessels, which unite in the centre of the lobule, and are named intralobular veins. These intralobular veins pass into the sublobular veins, which are the primary rootlets of the venæ cavæ hepaticæ. The hepatic artery, after entering the portal canals, divides into branches, which are supposed to nourish the liver, and subsequently are lost to view by passing into the branches of the vena porta, and thus forming a single ramifying vessel.

The biliary tubes, commencing in each lobule, emerge at the circumference, run in the interlobular spaces, and, by uniting together in the portal canals, form, ultimately, the hepatic duct.

Thus it will be seen that the blood for the nutrition of the liver is brought by the hepatic artery, whilst that for the special function is brought by the portal vein. The blood being returned into the system by the hepatic veins, whilst the bile is carried off by the hepatic ducts.

It would appear, however, by the blood of the hepatic artery being passed through the portal circulation of the liver before entering the venæ cavæ hepaticæ, that some bile occasionally may be secreted from that source, and such has sometimes been found to be the case, for, in a few rare instances, the portal vein has been found entirely obstructed, whilst the secretion of bile has proceeded almost as usual.

The portal vein has by some been considered as forming a sort of third vascular system, for in it the venous blood collected from the intestinal canal is gathered into a large trunk, which passes into the transverse fissure of the liver to divide as previously mentioned. It is not clearly known how the portal blood has sufficient impetus to go through this additional circulation (for the portal vein has no valves). But by some the vis a tergo of the venous blood has been thought sufficient, whilst others have made the spleen the organ for its propulsion; a third party have considered that the portal vein has propulsive powers, though they have not adduced sufficient proof to support such an hypothesis.

The vena portæ is formed by the junction of the *superior mesenteric vein*, with the *splenic vein*, and branches from the stomach, pancreas, and gall-bladder, and inferior mesenteric. It carries blood of a very dark colour, and is unlike all other vessels of the body; for it commences, like a vein, by small branches, which converge to form a large trunk, behind the pancreas, and this entering the liver, resembles an artery in its mode of division and ramifications, and functions.

The excretory ducts of the *liver*, *tubuli biliarii*, arise from the acini or lobules, and ultimately join to form the *hepatic duct*, which unites with the *cystic duct*, to form the *ductus communis choledochus*.

The nerves of the liver are derived from the hepatic plexus of the sympathetic, and partly from the pneumogastric and phrenic nerves.

The *gall-bladder* is on the concave surface of the right lobe. It consists of a *fundus*, *body*, and *cervix*. It has three coats, a partial, external, or *peritoneal*, a middle one, fibrous, and a *mucous* coat. A duct proceeds from the cervix, called *ductus cysticus*, which joins the hepatic duct, and forms the *ductus communis choledochus*. This duct is about two inches and a half in length, and terminates in the duodenum.

The lining coat of the gall-bladder has a reticulated honeycomb appearance, but does not possess any follicles for the purpose of secretion. It is useful as a reservoir of the bile, and may possibly absorb some of the thinner parts of this fluid.

The cystic duct presents internally a number of folds, which are generally circular; sometimes they run perpendicularly, or in a spiral direction. Their free edge is concave. They are not sufficient to arrest the passage of fluid either way.

Its vessels and nerves are derived from the same as those of the liver.

The *pancreas* is a long, flattened, glandular body, placed in the back part of the epigastric region, behind the stomach, and in front of the spine. Its greater extremity, named the *head*, is connected by cellular substance with the duodenum; its lesser, called the tail, with the spleen. It has the stomach and small omentum in front, and is opposite the first lumbar vertebra. The parts found posterior to it are, the splenic and superior mesenteric vein, the trunk of the vena portæ, the superior mesenteric artery and accompanying nerves, the vena cava, the aorta, and pillars of the diaphragm; towards the left side it is in immediate relation with the renal vessels, the left kidney, and its capsule. Its upper margin is grooved by the splenic artery, and is contiguous to the first portion of the duodenum, the lobulus Spigelii, and cœliac axis; its lower border, thinner, rests against the duodenum and superior mesenteric artery; its head rests against the concavity of the duodenum, and touches the ductus communis choledochus; the left extremity rests against the spleen. Projecting from the head of the pancreas is sometimes seen a small depending portion of similar structure, which (when it exists) is called the lesser pancreas.

It resembles the salivary glands in structure, and is nearly identical in the fluid it secretes; hence it is often enumerated amongst the salivary glands. It has no distinct capsule, but a delicate cellular tissue unites the various lobules together. Each lobule emits a duct which passes directly into the large duct, running the whole length of the pancreas, from left to right. The pancreatic duct pours its fluid into the ductus choledochus, just before it opens into the duodenum; sometimes there is a second duct, which perforates the duodenum separately.

The arteries of the pancreas are branches from the hepatic, splenic, and superior mesenteric. Its veins go to the vena portæ, and its nerves are from the great solar plexus.

The *spleen* is a soft oblong body, of a purplish colour, situated in the left hypochondrium, between the large extremity of the stomach and the false ribs; its lower part is behind the colon, and rests upon the upper end of the left kidney; it is externally convex, internally concave, and is covered by peritoneum and its tunica propria.

The internal structure of the spleen is much disputed; some contend that the splenic artery terminates in very small branches, which are coiled up like the shell of a snail, and which admit of considerable distension; these have been named *helicine* arteries. This organ seems to be largely composed of cells, which communicate freely with the veins, as may be seen by injections, but less freely with the arteries; they seem to be an interposed structure, between the two vessels; they are elastic, and at times are liable to enormous distension, as in agues. A quantity of dark fluid is obtained from the spleen by pressure; this may be washed away by water, but does not seem to be of the nature of a secretion, for it has no excretory duct. It varies in size, at different periods of life; it is smallest in the infant, and becomes gradually larger as age advances, but in old age is found very much reduced in size.

Mr. Gray, in his recent admirable work on anatomy, describes the spleen as containing within it numerous small bodies which he names *splenic* or Malpighian corpuscles; he describes them as semi-opaque bodies, of gelatinous consistence, disseminated through its substance; more distinct in early than adult life or old age, they are ovoid or spherical, are appended to the sheath of the small arteries, each consisting of a membranous capsule, composed of pale fibres interlacing in all directions. Upon them are distributed minute ramifications of the arteries and thin capillaries, with dilated commencements of veins. For a minute description the reader is advised to refer to Gray's 'Anatomy,' p. 628.

Its artery, called the *splenic*, arises from the *cœliac*. Its veins assist in forming the vena portæ; it receives nerves from the great solar plexus.

The *kidneys* are two oval glandular bodies, smooth on their surface, but lobulated in the fœtus during the early months, placed behind the peritoneum on each side of the spine, resting upon the diaphragm and quadrati lumborum muscles, opposite the two last dorsal and two superior lumbar vertebræ. The right is a little the lower, in consequence of the situation of the liver. They are about four inches in length and two in breadth; they have two surfaces, an anterior one convex, a posterior one flattened; they have two extremities, of which the superior is the largest and nearest the spine; a convexity externally, and a concavity internally.

The boundaries of the right kidney are, superiorly, the renal capsule and liver; inferiorly, the cæcum, but scarcely ever descends so low; anteriorly, the ascending colon and duodenum; posteriorly, the diaphragm and quadratus lumborum; externally, the diaphragm and abdominal parietes; internally, the crura of the diaphragm, the psoas muscle, large vessels of the kidney, with the vena cava and spine.

The boundaries of the left kidney are, superiorly, the spleen; externally and posteriorly, as on the opposite side; anteriorly, the descending colon; and internally, its vessels, the crura of the diaphragm, psoas, aorta, and spine.

The kidneys have a *proper coat*, of a fibrous or cellular nature, and an anterior covering only of peritoneum; they are generally imbedded in a quantity of fat and loose cellular tissue.

They are composed of two substances: the outer portion, called *cortical* or *granular*; the inner one, *tubular* or *medullary*.

The *cortical* substance is about two lines in thickness as a general rule; but it sends considerable prolongations into the substance of the tubular part, which pass between its cones. Its colour is reddish, and its structure somewhat soft. It is composed of an immense number of small tubes, called tubuli uriniferi, in connexion with which may be seen numerous extremely minute granular bodies, called *Malpighian corpuscles*. Each of these latter is formed by a tuft of capillary arteries arranged in a slight dilatation of a *tubulus uriniferus*, which forms a capsule for it.

This capsule is pierced by an inferent artery (which, by its branches, forms the tuft), and from it proceeds a small efferent vein. These efferent veins unite to form small venous plexuses, which unite to form branches of the emulgent or renal vein.

It would appear then that the tubuli uriniferi and the Malpighian corpuscles form two distinct systems, through both of which the blood passes in its passage from the arteries to the veins, the latter being the first through which it goes. It has been suggested by Mr. Bowman that it is by the Malpighian corpuscles and tufts that the aqueous portion of the urine is secreted, whilst it is by the tubuli uriniferi and the venous plexuses immediately surrounding them, that the urea, uric acid, and the more saline portions are separated.

The medullary or tubular part consists of the continuations of the tubuli uriniferi, which are arranged in straight lines and in conical bundles, the base of which faces externally the apex towards the pelvis of the kidney. These cones are about ten or twelve in number; their apex is called the *mamella* or *papilla*, which is surrounded by a membranous tube, called *calyx*. These *calices*, by uniting form three or four large tubes, named *infundibula*, which open or dilate into the large fissure of the kidney, called *pelvis*. The pelvis of the kidney, in respect to the artery and vein, is behind and below. The emulgent vein is anterior, and the renal artery between them.

The kidneys are supplied with blood by the renal arteries, which divide into five or six branches before entering into their substance. These branches pass between the medullary cones, and terminate in capillary ramifications around the commencement of the urinary tubes.

The right renal artery is the longest, having to pass behind the vena cava to its distribution.

The renal veins, also called emulgent, empty their contents into the inferior vena cava; the left one is longest, having to cross over the aorta. It generally receives the left spermatic vein.

The nerves are principally from the renal plexus of the sympathetic, and a few from the solar plexus.

The *lymphatics* are numerous, and pass into the thoracic duct.

The supra-renal *capsules* are flattened bodies, resting on the upper extremity of each kidney. They are convex above and concave below; yellowish on the outside, browner inside, and generally have a cavity containing a deep brown or black fluid. They are large in the fœtus, and until the third month of fœtal life exceed the kidney in size, but are diminished at birth, and gradually decrease in size with age.

They have sometimes an artery direct from the aorta; their veins terminate in the vena cava on the right, and in the emulgent vein of the left side. The use of them is not known.

The *ureters*, continuous tubes from the pelvis of the kidney, are about eighteen inches in length. They descend behind the peritoneum, over the psoæ muscles and large iliac vessels, enter the pelvis, and perforate the coats of the bladder, along which they run for about an inch, and terminate in the bladder, about an inch from its cervix, forming the posterior angles of the *trigonum vesicæ*.

They are of about the size of a goose-quill, have two coats, the outer one fibrous, and the inner a thin lining mucous coat; the narrowest part is between the coats of the bladder.

In the male, they are crossed at their upper part by the spermatic vessels; lower down they are crossed by the vas deferens. The latter hooks round the ureter, to reach the vesicula seminalis of its corresponding side.

In the female, they are crossed by the spermatic vessels, the Fallopian tubes, and broad ligaments; they run along the sides of the vagina, and when in the coats of the bladder are in close relation with the neck of the uterus.

PELVIC VISCERA.

The male pelvis contains the *bladder*, *prostate gland*, *vesiculæ seminales*, *vasa deferentia*, and the *rectum*.

In the female pelvis are the *bladder*, the *uterus*, with its appendages, and the *rectum*.

The *urinary bladder* is a musculo-membranous bag, situated in the fore part of the pelvis behind the symphysis pubis; but, when distended, it partly rises into the abdomen; and, when much distended, rises almost as high as the umbilicus.

It is divided, for the sake of description, into a fundus superior, a body, the inferior fundus, and the cervix.

Its coats are three: a partial *peritoneal* one, which covers the fundus, back part, and sides; the muscular; and the *villous* or lining mucous coat. The muscular coat consists of three layers of fibres, longitudinal, circular, and oblique. The longitudinal fibres are the most numerous, passing over the entire surface; anteriorly they are firmly connected with the pelvic fascia, which are by some considered as the tendons of the bladder. This coat is sometimes called the detrusor urinæ. The circular fibres are seen best near the neck of the bladder, and are by some named the sphincter vesicæ. The oblique fibres are collected into fasciculi, which cross each other at right angles, and cover the bladder only partially, thus facilitating the production of sacculi in the bladder. The mucous coat is thin and pale, and has a smooth appearance when the bladder is distended, but, when empty, it is thrown into rugæ; a triangular portion always smooth, bounded posteriorly by the opening of the ureters, laterally by the vesiculæ seminales, and anteriorly by the orifice of the urethra, is named the *trigonum vesicæ*. It is in this spot that the bladder may be perforated per rectum. The anterior part of this triangle sometimes presents an elevation, which has been called *uvula vesicæ;* it appears only to coexist with a diseased state of the prostate gland, in which case it simulates a third lobe of the prostate, and was considered to be such by Sir Everard Home.

The openings into the bladder are the anterior one from the urethra, and the two posterior and lateral, viz., orifices of the ureters.

The arteries are from the internal iliacs; the veins unite with the large iliac veins, and the nerves are from the sympathetic and sacral.

The bladder is kept in its situation by ligamentous fibres, which have received particular names. It is attached superiorly and laterally to the pubis by processes of the transversalis fascia, called *anterior ligaments;* laterally and inferiorly it receives fibres from the pelvic portion of the fascia iliaca, under the name of *lateral ligaments.* The false ligaments are five; *two posterior, two lateral,* and *one superior.* They are reflexions of peritoneum. The posterior folds of peritoneum pass from the bladder towards the fore part of the rectum; they contain the ureters and obliterated umbilical arteries.

The lateral folds extend to the iliac fossæ, containing the vas deferens in the male, and the round ligaments of the female.

The superior fold is the reflexion of the peritoneum upwards, upon the remains of the urachus.

GENITAL ORGANS.

The *testes* are two glandular bodies, situated in the scrotum, separated from each other by a cellular substance, called the septum scroti.

The coverings of the testicle are the *scrotum*, consisting of *skin, dartos, cremaster, superficial fascia* and *tunica vaginalis.* The immediate coverings of the testicle itself are *tunica vaginalis testis, tunica albuginea,* and *tunica vasculosa.*

The body of a testicle is composed of an immense number of whitish tubes, called *tubili seminiferi,* which are collected in bundles, and transmit or give off the vasa recta, which, at the posterior border of the testis, partly form the rete testis; from this the tubes ascend, and terminate in the vasa efferentia or coni vasculosi, which perforate the tunica albuginea at its upper part, and being convoluted, there form the globus major. The vasa efferentia all terminate in the vas deferens, which forms, by its convolutions, part of the globus major and the globus minor; it then ascends, and assists in forming the spermatic cord.

The *spermatic cord* is composed chiefly of the spermatic artery and veins, the spermatic nerves, lymphatics, and the vas deferens, which are connected together by cellular substance, and covered by the cremaster muscle.

The arteries of the testes are the two *spermatic arteries,* which arise from the aorta, just below the renal arteries.

The right *spermatic vein* terminates in the inferior cava, and the left in the left renal vein. The nerves of the testicle are principally from the renal plexus.

The *vas deferens,* passing upwards from the epididymis, through the abdominal rings, crosses over the psoas muscle and iliac vessels, and, descending in the pelvis, gets to the side of the bladder, to which it closely adheres, and gradually approaches its fellow of the opposite side: it communicates with the vesicula seminalis of the same side.

The *vesiculæ seminales* are two small oblong membranous reservoirs, situated at the lower and upper part of the bladder. Each vesicula is formed by the convolutions of one tube, which, uniting with the vas deferens, forms the *ductus ejaculatorius communis,* and this pierces the prostate gland, and opens into the urethra in front of the veru-montanum.

The prostate gland is a firm glandular body, somewhat of the shape and size of a horse-chesnut, divisible into two lateral lobes, situated at the neck of the bladder; through its substance the urethra passes. Its ducts, ten or twelve in number, open into the urethra, on the sides of the veru-montanum.

The most important of the female genital organs is the uterus with its appendages.

The *uterus* is a hollow viscus, situated in the female pelvis, between the bladder and rectum. It is divided into a *fundus, body,* and a *cervix.*

It is composed of three coats: an external or *peritoneal* covering, a *muscular,* and a *mucous* coat.

It has three openings into it: two at the angles of its fundus, leading to the Fallopian tubes; and one at its neck, leading to the vagina.

The appendages of the uterus are, the *broad ligaments, round ligaments, ovaries, Fallopian tubes,* and *vagina.*

The *ligamenta lata,* or broad ligaments, are two doublings of the peritoneum, sent off from the sides of the uterus to be attached to the sides of the pelvis. They contain and support the *ovaries*, *Fallopian tubes*, *ligamenta rotunda*, and the *vessels* and *nerves* of the uterus.

The *ligamenta rotunda*, or round ligaments, are two long roundish cords arising from the upper and anterior part of the uterus, in front of and below the Fallopian tubes. They pass through the abdominal rings, and are lost upon the pubes. They have a fibrous appearance, contain several small vessels, and are even supposed by some to be muscular. They serve to keep the uterus in its position.

The *ovaries* are two oval bodies, situated in the ligamenta lata, and connected to the uterus by small ligaments. They contain numerous vesicles, called vesicles of De Graaf. The constituents of each Graafian vesicle are an *ovicapsule*, *membruna granulosa*, the *yelk*, a *germinal vesicle* with a *macula germinitiva*. In each menstruation and in coition a vesicle is supposed to be detached, and its place supplied by a new deposit of a yellow appearance, which has been named corpus luteum.

The *Fallopian tubes* are two small tubes, proceeding from the angles of the uterus towards the lateral part of the pelvis. Their outer extremities are expanded in the form of a membranous fringe, called corpus fimbriatum. They are open at their extremities into the abdomen, which affords the only instance of direct continuation of mucous and serous membrane.

The *vagina* is a musculo-membranous canal, extending from the neck of the uterus to the pudendum. It is most covered by peritoneum at its upper and back part, where the peritoneum forms a cul-de-sac. Internally, it is lined by a mucous membrane.

The uterus and its appendages are supplied with blood by the uterine and spermatic arteries.

Its nerves are from the *lumbar*, *sacral*, and *great sympathetic:*

PARTS PECULIAR TO THE FŒTUS.

In the fœtus, until about the sixth month, a membrane, called *membrana pupillaris*, closes up the pupil of the eye; it is attached to the loose edge of the iris, and disappears some time before birth. It separates the anterior from the posterior chamber of the aqueous humour.

The *thymus gland,* situated in the anterior mediastinum, is very large; it gradually diminishes the first year after birth.

The parts peculiar to the fœtal circulation are, the *foramen ovale* of the heart; *canalis arteriosus; ductus venosus;* the *funis,* or *umbilical cord;* the *umbilical vein;* and the two *umbilical arteries.*

The *foramen ovale* is an opening of communication between the two auricles, by means of which the blood from the inferior cava passes directly into the left auricle.

The *canalis arteriosus* forms the medium of communication between the pulmonary artery and aorta.

The *ductus venosus* passes from the umbilical vein to the inferior vena cava.

The *umbilical vein* passes from the umbilicus to the liver.

The *umbilical arteries* arise from the internal iliacs, and pass up to the umbilicus, and thence to the placenta.

The *umbilical cord* consists of the umbilical vein and two umbilical arteries; it passes from the placenta of the mother to the umbilicus of the child.

PHYSIOLOGY.

The description of the various tissues forming the human body, as well as the functions of the various parts, is generally considered under this head. The relative arrangement of parts belongs to special anatomy, and the chemical composition is referred to animal chemistry.

Every part of the human body may be considered as primarily developed from cells, these cells by a series of changes becoming finally converted into the various structures, such as bone, cartilage, muscle, ligament, &c.

Every cell has a proper investing membrane or cell-wall enclosing contents, which may be fluid or solid; each cell also generally contains one or more nuclei. In the most simple cells there is hardly any discernible difference between the animal and vegetable kingdoms.

Each cell appears to have the property of secretion and nutrition,—that is to say, it can secrete or form new contents varying in properties, or it can enlarge, alter, or develop its form through a long series of changes, terminating in the formation of permanent structure. Cells also appear to be capable of reproduction,—that is to say, one cell can either within or outside of its own proper coat develop one or more new cells.

It may be considered that no cell comes into action, except under the influence of the vital stimulus. The cells of vegetables, however, may remain in a dormant state for years, and yet be finally awakened by a combination of circumstances; but those composing animal bodies must be vivified at once, or otherwise they very soon become absorbed and decomposed. The vital stimulus has not been yet demonstrated, but certain other well known stimuli appear also to be necessary; such as heat, light, and electricity; there are also some adjuvant stimuli such as moisture, &c.

Epithelium.—The whole surface of the body, as well as the walls of the various cavities, is covered entirely by a thin, transparent, well-defined structure, named differently according to the parts in which it exists, or to which it is applied; thus, the structure covering the external surface is called the epidermis, whilst that investing the mucous canals is called epithelium. These, however, differ from the epithelium of synovial and serous membranes, a fifth class being composed of the internal coverings of the vascular canals.

Epithelium is supplied with neither vessels nor nerves, though it is nevertheless composed of organized structure. It is formed by nucleated cells, bound together by intercellular substance. The deeper ones are more or less spherical in form, but the superficial are in general flattened, and finally become desquamated. There are several forms of epithelium, the following being the principal:

1. The *scaly*, or *squamous* epithelium is found on the free surface of serous membranes, and on the inner surface of the heart, blood-vessels, and absorbents, as a single layer; but on the skin, conjunctiva, and great mucous passages, it exists in the form of many strata. This variety appears to be composed of flattened cells, each containing a nucleus and generally some corpuscles.

2. *Columnar* epithelium is composed, as its name signifies, of a number of oblong perpendicular cells, in general broader at their superficial extremity than at their base. The columnar epithelium is formed by single nucleated cells, bound together by intercellular substance, and is found principally in the stomach, intestines, and urethra. It is also found in the gall-bladder.

3. *Spheroidal* epithelium (as described by Mr. Bowman) appears to be a transition between the two former varieties. Its cells are more or less spherical or cubic in form. It may be found lining the excretory ducts of most glands.

4. *Ciliated* epithelium is that peculiar variety in which small vibratile processes called cilia (from their resemblance to small eyelashes in form) stud the entire surface of the membrane which it covers. The ciliated epithelium is formed by nucleated cells, resembling those of columnar

epithelium, from the extremity of each of which small cilia project. The constant motion existing in these bodies causes the gradual, but certain passage of fluids along its surface. The motions of the cilia continue more or less actively during the whole of life, and exist for some time even after death. The length of the cilia varies considerably with the nature of the parts which they cover. The fluids pass, however, always in one direction.

Ciliated epithelium is found on the air-passages almost throughout, and in the Eustachian tube. It is also found in the uterus and Fallopian tubes, as far as the fimbriated extremities, and in the membranes lining the ventricles of the brain.

Pigment Cells.—In various parts of the body are found certain coloured portions. This is evident in the skin of the negro, and in some parts of the skin of the other races of mankind. This colour is owing to a peculiar black pigment found in cells, and composed of carbon in large proportion, together with nitrogen, hydrogen, and oxygen.

The *pigment* cells of the skin of the negro are found lodged in the rete-mucosum. They are somewhat smaller than those of the choroid, and are generally hexagonal in appearance. According to some, the pigment layer in the negro forms an additional stratum, and it may be separated from the cuticle by long digestion in water, but this circumstance is not sufficient to establish its separate character. The pigment cells of the choroid, and of the uvea of the iris, are both more or less hexagonal in shape, and of all forms, varying from that to the spherical. The pigment itself appears to be the peculiar, coloured, granular substance, and the coloured nucleus contained within the cell. In some rare instances in the human race the pigment of the skin, the choroid, and the hair appears to be deficient. In this case the individual is called an albino.

Adipose tissue.—The principal part of the fat of the body is found enclosed in small cells, more or less rounded in shape, and by the aggregation of which is formed adipose tissue. Adipose substance, in younger subjects, is generally lodged in the subcutaneous cellular tissue, but as age advances, it becomes more and more confined to the trunk, surrounding and enveloping the internal organs, such as the kidneys, &c. It also exists more or less about the joints, and within the cavities of the bones of which it forms the marrow. There are few parts of the body in which fat may not be deposited, but none exists as a rule in the cellular tissue of eyelids, penis, or scrotum; nor in the lungs nor the cavity of the cranium.

The fat in the human body generally exists more or less in a state of fluidity during life, but after death it becomes much more solid. Fat-cells are tolerably well supplied with blood-vessels, but no nerves are distributed to them.

Areolar Tissue.—This substance was formerly incorrectly named cellular tissue, but in the present day it is well known that no cells exist in its substance: it is composed of a large number of small transparent fibrils, each of which is about $\frac{1}{20000}$th of an inch in diameter; these, by interlacing and crossing one another, give it the appearance from which it derives its name. Cellular tissue is (like the other structures) developed from cells, and is readily reproduced when destroyed by any cause. It is very sparingly supplied with blood-vessels, and no nerves have been found distributed to it. It is the connecting medium for all the other tissues, and may be named variously, according to its situation, as *subcutaneous*, *submucous*, *subserous*, *intermuscular*, &c.

Fibrous Tissue.—This structure is one that is most useful on account of its mechanical properties. It appears to bind together the various parts of the human body, either by connecting one part with another like a cord, or by enveloping or sending processes between different portions, and thus by its firmness keeping their relations complete. The leading forms in which it is found in the human body are as tendon, ligament, fibro-cartilage, white and yellow fibrous tissue, and the fasciæ. Fibrous tissue is formed by a number of minute fibres, chiefly parallel to one another, and but rarely interlacing; with these are mixed up a few nucleated fibres. The fibrous tissues are very sparingly supplied with blood-vessels and nerves; no lymphatics have been satisfactorily traced in their substance. Fibrous tissues are slowly repaired after accident or injury.

Yellow Elastic Tissue.—This structure is found in the ligamentum nuchæ of quadrupeds, and in the spinal ligamenta subflava of man. The fibres forming this substance run somewhat parallel with one another, but, in addition, anastomose and interlace with one another in a very intimate manner. The elasticity of this substance is owing almost entirely to the mechanical arrangement of its fibres, for, when stretched too far it breaks with a very slight additional force.

Cartilage.—This substance is generally divided into two classes—the ordinary white cartilage, and the yellow, or *tissue jaune.* To the former belong the cartilages that cover the articular extremities of the bones, as well as the cartilages of the ribs, the ensiform cartilage, and the principal cartilages of the larynx. To the latter belong the cartilages of the eyelids, nose, and ear, as well as the epiglottis and cornicula laryngis. The white cartilages are composed of cells, each of which contains more or less nuclei, imbedded in a large quantity of substance called the matrix, which is of an uniform structure, and in which very few, if any, fibres are found. The white cartilages are, as a general rule, liable more or less to ossification, but the articular are an almost complete exception, cases of their being found ossified being extremely rare.

The yellow cartilages are much softer in structure, and like the white, contain nucleated cells, imbedded in a matrix; but they differ in their not being liable to ossification, and in their being in every direction pervaded with fibres. The cartilages of the body are all nearly, if not quite, unsupplied with blood-vessels. They also contain no nerves.

Fibro-cartilages.—These, as their name implies, are intermediate in their properties between the fibrous and cartilaginous tissues. They all combine to a considerable extent both firmness and elasticity, with toughness and flexibility. They are found in the body either as interarticular fibro-cartilages, or surrounding the edges of joints to deepen the cavity, of which a good example is seen in the cotyloid ligament of the hip-joint, or as connecting parts, in which a slight degree of motion is requisite but no synovial capsule exists, as between the bodies of the vertebræ, or as a thin layer lining the walls of the bony grooves in which tendons run.

Fibro-cartilage, when examined by the microscope, is found to be composed of bundles of fibres surrounding cartilage-cells. In some of the fibro-cartilages the one structure is more abundant than the other, and in most cases the fibrous tissue predominates. The vascularity of fibro-cartilage is very low, nor has it much tendency to ossific deposit.

Bone.—The chemical composition of this structure has been already given with the animal chemistry. Bones are commonly divided into three classes, long, flat, and mixed; the former in most instances possessing a shaft of compact structure (of which also the articular surfaces are composed), and the extremities, of which the tissue is spongy. Internally the long bones present a more or less circular canal, filled with marrow, the principal use of which appears to be to keep the cavity of the bone warm, to make it lighter, and to carry the blood-vessels which enter at the foramina to the more distant parts of the bone. The flat bones, with the exception of the sternum, have very little cancellated structure, and more of the vitreous, whilst in the mixed bones the two structures are about equally balanced; and though there may exist an internal cavity, it does not fulfil the same functions as the medullary cavity of the long bones.

Examined by the microscope, bone presents a large number of canals, varying from $\frac{1}{200}$th to $\frac{1}{2000}$th of an inch in diameter. The canals are larger in the internal portions of the bones than in the external. Their name is derived from their first describer, Clopton Havers. Each *Haversian* canal is surrounded by a number of concentric rings. The Haversian canals run parallel with the longitudinal axis of the bone in most places, and from them at right angles run numerous much smaller canals (*canaliculi*), leading to the surface of the bone. Between the concentric lamellæ that surround the Haversian canals, are seen numerous small specks, that appear solid, but are in reality hollow: these are named lacunæ. The bones are supplied freely with blood from two principal sources; the one being the periosteum, and the other the internal vessels that ramify throughout the marrow. It is doubtful whether they have any nervous supply: but a small twig has been seen entering the nutritious foramen of the tibia. Bone is tolerably easily reproduced when destroyed by disease or mechanical injury.

Muscle.—The structure of muscle is generally considered to be of three sorts, the first being that of voluntary muscle, the second that of involuntary in general, the third being that of the heart. Muscle may, in general terms, be styled the structure by means of which all the movements of the body are performed. Though in itself by no means strong as regards structure, yet under the influence of the will or other stimuli the power it exhibits is prodigious. And this must be still greater in reality than in appearance; power in nearly all instances being sacrificed to give increased extent of motion.

Voluntary muscles on a casual inspection are seen to be formed by a number of more or less coarse parallel fibres; these on inspection by a microscope are seen to be formed by a number of parallel fibrillæ. Every muscular fibril is enveloped in a peculiar sheath of its own, called sarcolemma, and as they do not anastomose or join each other, the muscular fibrillæ extend from one end of the muscle to the other. On examination with the microscope, voluntary muscular fibre is seen to be composed of a number of circular parallel discs, ranged one above the other, connected together by an intermediate softer substance, thus presenting an appearance of transverse lines, hence called *striated* muscular tissue.

The diameter of muscular fibres averages about $\frac{1}{400}$th of an inch, but in males the fibre is somewhat larger, and in females somewhat smaller than the above. Muscles are freely supplied with blood, and with nerves. It has long been a doubt whether muscles contract from an inherent irritability existing in themselves, or whether they do so only from the influence of the nerves supplied to them; but the latter hypothesis is the one generally entertained at the present time, and the experiments that have been made to endeavour to prove the contrary, are extremely unsatisfactory. The fibres of involuntary muscle differ very strikingly in their structure from the others, being much less (about $\frac{1}{2500}$th of an inch) in diameter, and much shorter. They are devoid of transverse striæ, and hence called *non-striated*. They contain nuclei, and interlace freely with one another, and have no distinct sarcolemma. They are found in all the viscera of the body, except the heart.

The muscular fibres of the heart are peculiar in arrangement and structure. Like those of the voluntary muscles, they are marked with transverse striæ, but are somewhat smaller in size like those of the intestines, &c., they anastomose with one another, and have no true sarcolemma. They intermix most intimately with one another in the substance of the heart.

Nervous Tissue.—A few words have been previously mentioned on this subject in the anatomical department. (*Vide* Anatomy of Nervous System.)

Arteries, on superficial inspection, appear to consist of three coats, which have been named external or *cellular*, middle or *elastic*, and internal *serous* or proper lining coat. Many anatomists of late years, assisted by the microscope, describe several layers, amounting to six or seven. Thus the internal layer may be divided into two, the innermost constituting the epithelium, the outer one is thin, formed of elastic, longitudinal and some transverse fibres, named the *fenestrated* or *perforated* membrane. The middle coat again is divided by some into two layers, the internal one containing involuntary muscular fibres, the outer being purely elastic. The outer cellular coat also consists of two layers, the inner one composed of yellow elastic fibres, the outer of white inelastic fibres and areolar tissue. Arteries are supplied with numerous small nutritious arterial branches, called *vasa vasorum*, and receive their nerves from the sympathetic.

Veins.—The veins, like the arteries, ramify throughout the whole body. The leading points of difference between the two are the following.

The veins are as a rule much more lax and capacious than the arteries, as well as more numerous; so that the venous blood in the body at any one time exceeds by at least twice the amount that is contained in the arterial system. To this rule the pulmonary circulation is the only exception.

The veins are arranged in two leading sets, the superficial and the deep, the former accompanying no arteries, the latter running along the sides of arteries as *venæ comites* or *satellites;* the smaller arteries have two or more venæ comites, the larger have only one.

In structure, the veins are much the thinner in their coats; they are, however, the same in number and kind as in the arteries, the only difference being that the longitudinal fibrous coat is extremely well developed, whilst the others are very thin, and scarcely discernible. The internal coat, however, is thrown at certain distances into folds, which form what are called the valves of the veins; these present their free, sharp, concave edge towards the heart, so that they favour the onward passage of the venous blood, whilst they almost entirely check its return. The very smallest veins (which closely approach to capillaries in their structure), as well as the very largest, have no valves. The muscular structure of the auricles of the heart extends for some distance along the cavæ, pulmonary artery, and pulmonary veins.

Capillaries.—Between the terminations of the arteries and the commencement of the veins exists a third portion of the circulating medium, viz., the capillary system. The small vessels of the capillary circulation anastomose with one another much more freely than the arteries, or even the veins. They vary in size from $\frac{1}{1500}$th to $\frac{1}{3000}$th of an inch in diameter,—these being the extremes. Some of the capillaries have three coats, like the other vessels; but the smallest do not appear, for certain, to have more than one. It is in the capillary circulation of the body that nearly all the changes in its composition take place; it is in them that the carbonization of the blood is effected, and animal heat produced; it is from them that the bile, sweat, and urine are secreted, &c.

Lymphatics or *Absorbents.*—The coats of the lymphatics are still thinner than those of the arteries or the veins, but they are much stronger in reality than one would be led to expect from their appearance. They have three coats, of which the external is fibro-cellular, the middle muscular (Gray) and the internal epithelial.

Like the veins, the lymphatics are furnished with valves, which exist in such numbers as to give the vessels, when distended by injection, a knotted or beaded appearance.

Lymphatic Glands.—These are composed of numerous finely divided lymphatic vessels, surrounded by a plexus of blood-vessels, and bound together by cellular tissue. The absorbents leading to them are more numerous and smaller than those which pass out from them. The former are called vasa inferentia, the latter vasa efferentia. The absorbents, or lymphatics, ultimately terminate by pouring their contents into the veins, generally by two large trunks, viz., the thoracic duct, which opens into the angle of junction of the left subclavian and left internal jugular veins, and the ductus lymphaticus dexter, which opens into the right subclavian vein near its junction with the right internal jugular vein.

Serous Membranes are very delicate structures, lining a shut sac, except in the case of the peritoneum of the female, where we have a continuity of mucous and serous membrane at the extremity of the Fallopian tubes. Their free surface consists of a delicate scaly epithelium; next to which is the basement membrane of Dr. Todd, consisting of elastic fibres and areolar tissue; and external to this is the subserous areolar tissue, connecting it with the neighbouring parts.

The principal serous membranes of the body are, the *arachnoid*, *pleura*, *pericardium*, *peritoneum*, and *tunica vaginalis*. The basement membrane has numerous vessels and nerves external to it, but is not distinctly permeated by them.

Synovial Membranes, like serous, line shut sacs; they differ chiefly in the quality of the fluid which they secrete, and which contains a much larger proportion of albumen. They have three layers, viz., the epithelial, basement membrane, and reticulated connecting layer. There are varieties of them: 1st, those proper to the joints; 2dly, those constituting *bursæ mucosæ*, as they are called; and 3dly, the sheathing variety, extended around and accompanying tendons forming sheaths to them, as about the ankle and wrist joints.

Mucous Membranes line all the open passages of the body; they are all exposed directly or indirectly to the contact of the atmosphere. Strictly speaking there are only two large mucous surfaces, one named *gastro-pulmonary*, extending from the mouth and nose to the anus; the other named *genito-urinary*, lining the urinary and genital apparatus. To these a third might be added, viz., the mucous membrane lining the mammary tubes. They present an attached and free surface, the latter being remarkably uneven in many parts of the body. They generally present a roseate tint, on account of the numerous vessels belonging to them.

Mucous membrane in structure is more complex than serous, and bears a considerable analogy to the skin, of which it may be called the internal reflexion. It consists of epithelium, then basement membrane, and next the fibro-cellular layer, in which are found the numerous vessels and nerves supplying it in certain parts. This membrane presents numerous small elevations, named papillæ, but which contain the essential parts of the membrane itself, and in other parts very numerous depressions or sacs are found opening upon the surface, and pouring out various secretions in the different parts, as the follicles of the stomach, crypts of Lieberkühn, &c.

Secreting Glands.—These are of several varieties, which can however be best divided into three.

The simplest form of secreting gland is that in which the substance is secreted by the wall of a simple cell, which, when it is filled, bursts into the adjoining cavity.

The next form is that in which, in order to increase the acting surface, the secretory surface projects, or is folded so as to afford additional superficies. Several varieties of this sort of gland exist, in some of which the surfaces are serrated or notched for a similar purpose.

In the third case the membrane is more or less inverted, so as to form an increase of surface without lessening the calibre of the cavity. In this variety some of the secretory apparatus are merely simple pouches, with a more or less constricted orifice, whilst in others there is an evident duct, and this in many cases more or less branched, and eventually terminating in the real secreting cells.

In most glands the separate portions are bound together by a cellular substance, called parenchyma, in addition to which many glands have a regular fibrous covering.

In some instances there exist more or less perfect reservoirs, in which the secretion is kept for a short time previously to its being used or eliminated. The structure of these is generally somewhat fibrous with a mucous lining, a few muscular portions being intermixed.

OF THE NUTRITIVE FUNCTIONS.

Mastication and Insalivation.—The food being taken into the mouth, is retained there and brought under the influence of the teeth by the lips, the buccinator muscles, and tongue. By the lateral motions of the lower jaw, effected by the pterygoid and assisted by the masseter muscles, the inferior molar teeth grind the alimentary substance against the upper ones. During this time the food becomes mixed with the saliva and mucus of the mouth, which convert it into an easily-swallowed bolus, and also fit it for digestion and assimilation.

Deglutition.—When the food has been sufficiently divided and imbued with saliva, it is placed in a mass upon the dorsum of the tongue, which is rendered concave for its reception. The mouth is then closed, the apex of the tongue applied to the roof of the mouth, and the rest of the organ brought successively in contact with it, from before backwards; the food having no other way to escape this pressure, slides down the inclined plane formed by the tongue, through the isthmus faucium, into the pharynx, which is drawn upwards and forwards to receive it. At this time the *velum palati* is elevated, and thus prevents the food getting into the nostrils or Eustachian tubes. The larynx is raised, and rather inclined forwards, at the same time that the pharynx is elevated, so that the glottis is brought under the epiglottis, which amply covers it, and thereby prevents the food from entering that cavity. As soon as the food has passed the isthmus into the pharynx, the velum is depressed, and thus cuts off the return of food into the mouth, at the same time that it assists in its descent. The moment the food has passed into the pharynx, its constrictors begin to act, and rapidly force it into the œsophagus. The larynx, pharynx, velum, &c., are now restored to their natural position.

Digestion.—The alimentary matter being propelled by the contractions of the œsophagus into the cardiac extremity of the stomach, becomes acted upon by the gastric juice, which, assisted by the heat and muscular contraction of the stomach, quickly dissolves the digestible part, and entering into union with it, produces a new fluid, called *chyme*. The chyme is gradually conveyed, by a kind of peristaltic motion, from the cardiac to the pyloric end of the stomach. When it has been sufficiently operated upon by the stomach, it passes through the pylorus into the duodenum. The pylorus possesses a peculiar sensibility, which may be considered as a kind of sentinel, that prevents any matter from passing through it, but such as has been properly converted into chyme.

Chylification.—The chyme having passed through the pylorus into the duodenum, becomes mixed with the *biliary*, *pancreatic*, and *intestinal* secretions. These juices, by their action upon the *chyme*, separate it into two portions, one a milky fluid, called *chyle*, and another, the excrementitious portion. By some, the alkaline and saline ingredients of the bile are supposed to combine with the chyle, while the albumen and resinous matter combine with the excrementitious portion. The chyle attaches itself to those irregular circular folds of the mucous membrane of the small intestines, called valvulæ conniventes, where it is absorbed by the lacteals, and conveyed to the thoracic duct. The large intestines also possess lacteals, so that if any portion of chyle should not have been absorbed in the small intestines, it is taken up in the large ones. The fæces pass from the small to the large intestines and there acquire that peculiar fetid odour which distinguishes them. They are gradually urged on into the sigmoid flexure of the colon and rectum, where they remain for a certain time, and are then discharged.

Excretion of the Fæces.—The fæces gradually accumulating in the rectum stimulate it to discharge its contents; and the diaphragm and abdominal muscles expel the fæces, overpowering the levator and sphincter ani. After the excretion, the levator chiefly retracts the intestine, which is again closed by its sphincter.

Absorption and Course of the Chyle.—The absorbents which take up the chyle in the intestines are called *lacteals*. They are most numerous in the jejunum. The lacteals of the small intestines, and part of the large, convey the chyle to the mesenteric glands, where it is supposed to undergo some change, which is rendered evident by a change of colour; the fluid which passes from the gland has a more pink and rather less milky appearance. Passing from one gland to another, they ultimately form a small number of large trunks. These accompany the superior mesenteric artery to the right side of the aorta, and there join the thoracic duct. The thoracic duct is formed by the junction of the lacteals with the lymphatics of the pelvis and lower extremities. It begins on the third lumbar vertebra, and here swells out into an oval sac, called *receptaculum chyli.* Proceeding upwards, on the right side of the aorta, it passes through the aortic opening of the diaphragm into the posterior mediastinum. On the fourth dorsal vertebra it crosses behind the aorta to reach the left side of the neck, and terminates in the angle of union of the subclavian and internal jugular veins.

Use of the spleen.—The physiology of the spleen is not understood. By some it has been thought subservient to the function of the liver, by preparing a fluid for the vena portæ. Others consider it subservient to the stomach, and that it receives the surcharge of blood when the stomach is empty. The most rational theory is that of Mr. Dobson: he found that the spleen receives most blood during digestion, and that, when digestion is completed, it recovers its normal condition. Hence he imagined that the spleen becomes a reservoir or diverticulum for a part of the blood, until the system can accommodate itself to the additional fluid which has been thrown into the circulating mass of fluids. Some modern physiologists imagine that the spleen is subservient in producing the colouring matter of the blood, and that it indeed may be said to form the red globules, but on insufficient grounds.

THE BLOOD.

The blood when first drawn from the living body appears homogeneous; but, submitted to the microscope, exhibits an almost colourless fluid, with numerous red and white globules floating in it. By standing, it coagulates in from three to seven minutes, and after a space of half an hour or more, it separates into two parts—serum and crassamentum.

Thus the blood at first consists of *liquor sanguinis* (or *plasma*) and red globules. The crassamentum formed afterwards contains the fibrine of the liquor sanguinis, as well as the globules entangled in its meshes. Besides the red corpuscles, numerous pale corpuscles are found in the blood.

The red corpuscles, or globules, in man, are circular, flattened, biconcave discs, about $\frac{1}{3500}$th of an inch in diameter, and a fourth of that measure in thickness. They are generally of the same form in the mammalia, excepting the camel, in which they are rather ovoid. In reptiles, birds, and fishes, they are generally oval, with a central thicker nucleus, instead of a depression. They vary much in size in animals; are largest in the elephant amongst the mammalia; smallest in the napu musk deer, according to Mr. Gulliver, not exceeding the $\frac{1}{12000}$th of an inch in diameter. They are largest in the proteus, the siren, and the frog; being in the proteus $\frac{1}{400}$th of an inch in diameter.

The red corpuscles consist of a colourless envelope, surrounding the colouring matter; and in those cases where there is a central nucleus, the colouring matter is deposited around it. The human discs, by allowing the blood to rest, have a tendency to collect together in rows by their flat surface, like rolls of money.

The *pale corpuscles* are fewer than the red, and generally of a larger size; they are more spherical, present an uneven surface, and are found to contain one or more granules. They may be considered as transitional, or undeveloped red corpuscles.

The coagulation of the blood is usually said to be owing to the tendency of the fibrine to take on the solid form, but from the elaborate researches of Dr. Richardson, it appears to depend upon the escape of sulphide of ammonium. In inflammation the clot often presents a buffed appearance, which is explained in two or three ways; either the blood coagulating more slowly, more time is allowed for the subsidence of the red particles, leaving some fibrine at the surface free from them; or the red globules unite more firmly and rapidly, and sink sooner; or, the contraction of the fibrine being stronger, it squeezes out of its meshes the red globules, which sink by their gravity, and retains the pale ones at the top, they being much lighter.

Arterial blood is now considered to coagulate rather sooner than venous.

Coagulation is promoted or accelerated by heat slightly above the natural temperature: also by exposure to air, increased extent of surface, agitation, and by faintness, as in hæmorrhages. Coagulation is retarded by cold, exclusion of air, copious dilution with water, caustic potash and soda, and acids.

Circulation of the Blood.—The blood is returned from the upper part of the body by the superior vena cava, from the inferior part by the inferior cava, and from the heart itself by the coronary vein to the right auricle. This contracts and discharges its contents into the right ventricle: when completely filled, the right ventricle contracts; by that contraction, its tricuspid valve is brought into action, and prevents the blood returning into the auricle, and the contents are propelled through the pulmonary artery and its ramification to the lungs. From the lungs the blood is returned by the four pulmonary veins to the left auricle, which, being distended, now contracts, and throws the blood into the left ventricle. The left ventricle then contracts, its mitral valve closes the opening, and the blood is propelled through the aorta into the capillary system, to be again returned by the veins. The aorta and pulmonary artery are each guarded by three semilunar or sigmoid valves, which prevent the blood returning into the ventricles.

Fœtal Circulation.—The circulation of blood in the fœtus is considered now to be carried on in the following manner: the blood, purified in the placenta, is carried to the fœtus by the umbilical vein, which, running along the longitudinal fissure of the liver, gives branches to each lobe of it, and its continuous branch passes to the inferior vena cava, under the name of the *ductus venosus:* next, the blood of the inferior cava enters the right auricle of the heart, and is directed by the Eustachian valve through the foramen ovale into the left auricle, from which it passes into the left ventricle, and thence into the ascending aorta. Nearly all this blood goes to the head and upper extremities, from which parts it returns to the heart by the superior cava, and enters the right auricle, in which, separated by the Eustachian valve from the lower current, it passes on to the right ventricle, and thence into the pulmonary artery, which in the fœtus has three branches, the two pulmonary arteries, as yet very small, and a third large trunk, named *ductu arteriosus*, leading into the lower part of the arch of the aorta. Most of the blood then received by the pulmonary artery passes into the aorta, very little into the lungs; and the blood thus received by the aorta descends to supply the lower parts of the body, a large portion of it finding its way into the umbilical arteries (then very large), to be carried back to the placenta to be purified.

This kind of circulation is highly probable, when we take into consideration the superior development of the head and upper extremities, the situation of the Eustachian valve, and the peculiar direction in which the ductus arteriosus enters the aorta: this is the description which is now more generally received.

The temperature of the blood is about 98°. The cause of it is not perfectly agreed upon. Some attribute it to the caloric evolved in the lungs, arising from the union of oxygen with carbon, and say that it is carried by means of the blood to the different parts of the body; others more rationally consider that caloric is evolved in the general capillaries at the time of the conversion of the arterial into venous blood, by a process analogous to combustion, which is so probable, that scarcely any other hypothesis appears requisite. Sir B. Brodie considered that the nervous system is mainly concerned in the production of animal heat.

Of Respiration.—The air is received into the lungs by the enlargement of the cavity of the chest. The powers which effect this enlargement, in common inspiration, are the diaphragm and intercostal muscles; in forced inspiration, many other muscles are brought into play, such as the trapezius, rhomboidei, levator anguli scapulæ, pectoralis major and minor, subclavius, scaleni, serrati postici, serratus magnus, and latissimus dorsi, and all the muscles between the chest and the chin. The blood of the pulmonary artery being exposed to the influence of the air in the lungs, is converted from a dark colour into a florid red, by parting with carbonic acid and the absorption of oxygen. Combined with carbonic acid, a watery vapour is likewise evolved. When the blood has been properly acted upon, the inspiratory muscles relax, while the abdominal muscles, pressing the viscera upwards against the diaphragm, diminish the cavity of the chest, and thus expel the air. In forced expiration several muscles assist; they are the triangularis sterni, serrati postici inferiores, levatores ani, quadrati lumborum, latissimus and longissimus dorsi.

OF SECRETION.

The term secretion is applied to that process by which parts of the blood are separated in the various organs. The manner in which secretion is effected is perfectly unknown.

The secretions may be divided into *exhalations*, *follicular secretions*, and *glandular secretions.*

A distinction is made by some between secretions and excretions in this way, viz., a secretion is something which is capable of causing changes in other parts before it leaves the body: an excretion is something thrown off from the body as useless, and even injurious, and although retained some time produces no beneficial change in other fluids or solids.

Of the Secretion and Excretion of the Tears.—The tears are secreted by the lachrymal gland, from whence they are conveyed by six or seven excretory canals to the upper and outer part of the eye, where they pass through the conjunctiva, and are carried by a triangular canal, formed by a meeting of the eyelids, to the inner canthus of the eye, where they are absorbed by the *puncta lacrymalia*, and conveyed by two tubes to the *lachrymal sac.* From the *lachrymal sac* the tears pass by the *nasal duct* into the inferior meatus of the nose.

Use of the Tears.—The tears keep the cornea moist, prevent the friction of the eyelids on the eyes, and wash away any extraneous bodies which may have fallen into the eye; they are of much use to the nose by lubricating the membrane, and thus contributing to the perfection of smelling.

Secretion of Milk.—The milk is secreted in the glandular substance of the mammæ. The *tubuli lactiferi* commence in numerous small portions of the gland, called *granules.* As they approach the nipple, the ducts unite into twelve or fifteen, of considerable size, which terminate on the surface of the nipple by open mouths. The milk is only for the purpose of nourishing the infant.

Secretion of Saliva.—The saliva is secreted by the parotid, submaxillary, and sublingual glands, and conveyed by their ducts into the mouth. Its use seems to be, to assist the mastication and deglutition of the food, and its digestion in the stomach; any more special use is doubtful, although it is affirmed by some that it converts starch into dextrine.

Secretion of Gastric Juice.—The gastric juice is supposed to be secreted partly by the extreme arteries of the villous coat of the stomach, and partly within the follicles. It dissolves those substances which are nutritious to the animal, and has always an acid reaction.

Secretion of the Pancreatic Juice.—The pancreatic juice is secreted in the acini of the pancreas, and conveyed by numerous small ducts into the great pancreatic duct, which opens along with the ductus choledochus in the duodenum. It is supposed to assist in chylification, by diluting the bile, and adding to the saline ingredients. By some it is supposed to saponify the fat and oils taken, and by others to convert starch into sugar.

Secretion of Bile.—The bile is secreted in the liver by the minute branches of the vena portæ in the *acini* or lobules; from thence it passes along the excretory ducts, called the *pori bilarii*, into the *hepatic duct;* this, with the cystic duct, forms the *ductus communis choledochus*, which terminates in the duodenum. It is considered that the blood of the vena portæ, having more carbon and hydrogen than that of the hepatic artery, is more proper for furnishing the elements of bile.

Excretion of Bile.—When digestion is not going on, the opening of the *ductus choledochus* is closed by the contraction of the duodenum; and the bile therefore, not finding access into it, regurgitates into the gall-bladder, where it acquires greater consistence. When the duodenum is distended with chyme, the irritation it produces is propagated to the gall-bladder, the parietes of which contract, and force the bile along the cystic duct into the ductus communis choledochus, and from thence into the duodenum.

Use of the Bile.—The bile precipitates the fæces from the chyle, and excites the peristaltic motion of the intestines; it is also considered to be an outlet for carbon and hydrogen from the body.

Secretion of Urine.—The urine is secreted by the minute branches of the renal artery into the *tubuli uriniferi*: then passes through the *papillæ* or *mammary processes*, into the *calices*. These uniting, form three or four principal tubes, named infundibula, which terminate in the *pelvis* of the kidney. The pelvis contracting forms the ureter, which carries the urine to the bladder.

The oblique manner in which the ureters penetrate the bladder prevents the urine from returning; the inner membrane of the bladder lying over the opening produces the effect of a valve. It is also believed to be intended to prevent such over-distension of the bladder as might lead to rupture of it.

Excretion of Urine.—As soon as there is a certain quantity of urine in the bladder, we feel an inclination to discharge it. This we effect partly by the contraction of the bladder itself, and partly by the action of the abdominal muscles and diaphragm, which press the intestines against the bladder. The urine is the principal outlet for nitrogen.

Secretion of Semen.—The semen is secreted by the minute branches of the spermatic arteries in the testicles. It passes through the *tubuli seminiferi* into the *vasa recta*; contained in the *rete testis*. From the rete testis the semen passes by the *vasa efferentia* into the *coni vasculosi*, forming the head or *globus major* of the epididymis; then through the body of the epididymis into its lower part, called *globus minor* or *cauda*, in the convoluted *vas deferens*. The vas deferens opens with the *vesicula seminalis* into the urethra.

Use of the Vesiculæ Seminales.—They are generally supposed to receive the semen, and to effect some change in it. By some they are considered to secrete a peculiar fluid.

Use of the Prostate Gland.—The prostate gland secretes a peculiar fluid, which is discharged into the urethra by ten or twelve ducts. This secretion is combined and discharged with the seminal fluid, but its function is unknown.

Use of the Uterus,—The uterus is of service for the function of *menstruation*, and for the reception and nutrition of the *ovum*.

During coition the uterus is supposed to open a little, and draw in the semen by aspiration; the Fallopian tube directs it to the ovarium: the contact of the semen determines the rupture of one of the ovarian vesicles, which in a few days passes into the uterus. Some authors imagine that it is not the semen that is carried to the ovarium, but only the vapour that exhales from it, or *aura seminalis.* Others think the semen is absorbed, and carried to the ovaria by means of the arteries. No theory yet started carries much probability with it.

OF THE BRAIN AND ORGANS OF SENSE.

Of the Physiology of the Brain.—The uses of the brain in the animal economy are very numerous and important. It is the material organ of the *intellect* or *mind;* it gives, through the medium of the nerves, the power of *voluntary motion;* it is the seat of *sensation* and of *sympathies,* and exerts more or less influence upon all the vital phenomena.

The *sensations* are those functions destined to receive the impressions of external objects, and to transmit them to the intellect.

They are five in number, viz. *vision, hearing, smelling, taste* and *touch.*

Mechanism of Vision.—The rays of light, emanating from surrounding objects, which fall on the cornea, are in part reflected, and thus contribute to form the brilliancy of the eye. The transparent cornea refracts the remaining rays, and thus increases the intensity of light; the rays then pass through the anterior chamber, pupil, and posterior chamber to the lens. The number of rays which fall on the lens is regulated by the iris, which contracts or dilates, to allow more or less light to pass through the pupil, according as an object may be more or less lighted. Those rays that fall on the iris are reflected, and, returning through the cornea, exhibit the colours of the iris. The crystalline lens, both from its structure and form, very powerfully refracts the rays, and collects them into a focus, in the vitreous humour; from which point they diverge, and are spread out upon the retina in the bottom of the eye, where the impression is received, and conveyed along the optic nerve to the brain, and produces *vision.* The object is depicted in an inverted manner at the bottom of the eye.

The *conjunctiva* protects the anterior surface of the eye; it secretes a fluid which mixes with the tears, and seems to have the same use; it supports the pressure when the eye is moved, and being always polished and humid, it gives much facility to motion.

The *sclerotic* is evidently to protect the interior parts of the eye, and to serve besides as a point of insertion for the muscles that move the eye.

The *choroid* membrane is the most vascular coat of the eye, allowing the ramifications of the vessels, and secreting the pigmentum nigrum.

The *pigmentum nigrum* absorbs the light after it has traversed the retina, and thus prevents dazzling.

The dark matter, called *uvea*, on the posterior surface of the iris, is to absorb those rays that may be reflected by the polished surface of the crystalline lens.

The use of the *ciliary processes* is not perfectly understood. By some they are considered to secrete the aqueous humour. Haller thinks that they maintain the lens in the most advantageous position. Some physiologists think that they are muscular, and are able to produce changes in the convexity of the lens.

The *eyebrows* guard the eyes from external violence by the projection which they form; they protect the eyes from too much light, particularly when it comes from above, and they prevent perspiration from flowing towards or irritating the surface of the eye.

The *eyelids* during sleep cover the eyes, and thus preserve them from the contact of any foreign bodies floating in the air; they moderate the force of a too brilliant light; and by their regular and habitual motion, preserve the eyes from the effects of the continued contact of the air; and, by their sudden closure, guard them from any shock.

The secretion from the *meibomian glands* facilitates the motion of the eyelids, prevents them sticking together, and by its oily character prevents the tears passing over the edges of the lids.

Hearing.—The external ear, or *pinna*, collects the sonorous undulations, and directs them towards the *meatus auditorius externus*. This trumpet-like tube concentrates and conveys them to the *membrana tympani*. The sonorous waves striking against this membrane, cause it to vibrate; this vibratory motion will be also given to the *malleus*, which is in contact with the membrane. The malleus moves the *incus;* the incus, the *os orbiculare;* and this latter moves the *stapes*. Now the base of the stapes being attached to the membrane, closing the *fenestra ovalis*, it is evident that the stapes must act the part of a piston; that is, compressing or dilating the fluid in the *vestibule*, *semicircular canals*, and *cochlea*. The motion of this fluid conveys the impression to the *acoustic nerve* which lines the labyrinth. This nerve, receiving the impression, conveys it to the brain.

The *Eustachian tube* admits the free passage of air into and from the cavity of the tympanum, thus preserving a due balance with the external air, and enabling the membrana tympani to move in obedience to the slightest impression.

The *mastoid cells* are supposed to augment the intensity of the sound.

The *fenestra rotunda* and *aqueducts* are supposed to allow the liquid of the labyrinth to suffer vibrations.

Of taste. — To produce the sensation of taste the food must be moistened and applied to the tongue. The minute branches of the *lingual* branch of the third division of the fifth pair receive the impression, and convey it to the brain.

The *glosso-pharyngeal* nerve is thought by some to be also an important nerve of taste.

Of smell.—The air, filled with the odorous effluvia which exhale from most bodies, being received into the nostrils by inspiration, carries these particles to the olfactory nerve, which is expanded over the surface of the pituitary membrane. By these means a kind of sensation is produced, which we call smell. Mucus is secreted to preserve the extremities of the nerves, and to lessen the two strong impression that would arise from the immediate contact of the odoriferous particles.

Of the functions of the skin.—The *cutis vera*, or true skin, forms the organ of touch, besides which it is a medium for absorption, and has a function analogous to that of the lungs, namely, the discharge of useless carbon from the system. The carbonic acid produced in the process is formed by the union of the carbon with the oxygen of the atmosphere in the capillaries.

The *cuticle*, or *epidermis*, seems to blunt the otherwise too acute sensibility of the cutis vera, and to protect it from the impression of external bodies.

Of the voice.—The air expelled from the lungs passes through the trachea and larynx. In the latter, the passage for it is much smaller than in the trachea, and the air is forced through a narrow slit, the two sides of which are vibrating planes, and which then produce sonorous undulations in the transmitted current of air. The intensity of the sound depends on the length of the *chordæ vocales*, the distance between them, and the force with which the air is expelled. The modifications of the voice depend upon the alterations produced on the opening of the glottis by its muscles and ligaments; and articulation, upon the movement of the muscles of the mouth and palate.

DR. CULLEN'S TABLE OF NOSOLOGY OF THE CLASSES, ORDERS, AND GENERA OF DISEASES.

CLASS I.—PYREXIÆ.

FEBRILE DISEASES.

ORDER I.

FEBRES.	FEVERS.
§ 1. *Intermittentes.*	§ 1. *Intermittents.*
1 Tertiana . . .	1 Tertian Ague.
2 Quartana . . .	2 Quartan „
3 Quotidiana . . .	3 Quotidian „
4 Synocha . . .	4 Inflammatory Fever.
5 Typhus . . .	5 Putrid „
6 Synochus . . .	6 Mixed „

ORDER II.

PHLEGMASIÆ.	INFLAMMATIONS *attended with* FEVER.
7 Phlogosis . . .	7 Inflammation.
8 Ophthalmia . . .	8 „ of the Eye.
9 Phrenitis . . .	9 „ „ Brain.
10 Cynanche . . .	10 „ „ Throat.
11 Pneumonia . . .	11 „ „ Lungs.
12 Carditis . . .	12 „ „ Heart.
13 Peritonitis . . .	13 „ „ Peritoneum.
14 Gastritis . . .	14 „ „ Stomach.
15 Enteritis . . .	15 „ „ Bowels.
16 Hepatitis . . .	16 „ „ Liver.
17 Splenitis . . .	17 „ „ Spleen.
18 Nephritis . . .	18 „ „ Kidney.
19 Cystitis . . .	19 „ „ Bladder.
20 Hysteritis . . .	20 „ „ Uterus.
21 Rheumatismus . .	21 Rheumatism.
22 Odontalgia . . .	22 Toothache.
23 Podagra . . .	23 Gout.
24 Arthropnosis . .	24 Pus in a Joint.

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* This Nosology is introduced for the use of gentlemen on the Medical Service of the Army.

ORDER III.

EXANTHEMATA.	ERUPTIVE FEVERS.
25 Variola	25 Smallpox.
26 Varicella	26 Chicken Pox.
27 Rubeola	27 Measles.
28 Scarlatina	28 Scarlet Fever.
29 Pestis	29 Plague.
30 Erysipelas	30 St. Anthony's Fire.
31 Miliaria	31 Miliary Fever.
32 Urticaria	32 Nettle Rash.
33 Pemphigus	33 Vesicular Fever.
34 Aphtha	34 Thrush.

ORDER IV.

HÆMORRHAGIÆ.	HÆMORRHAGES *attended with* FEVER.
35 Epistaxis	35 Hæmorrhage from the Nose.
36 Hæmoptysis	36 „ „ Lungs.
37 Hæmorrhois	37 Piles.
38 Menorrhagia	38 Overflow of the Menses.

ORDER V.

PROFLUVIA.	FLUXES *attended with* FEVER.
39 Catarrhus	39 Catarrh.
40 Dysenteria	40 Dysentery.

CLASS II.—NEUROSES.

NERVOUS DISEASES.

ORDER I.

COMATA.	SOPOROSE DISEASES.
41 Apoplexia	41 Apoplexy.
42 Paralysis	42 Palsy.

ORDER II.

ADYNAMIÆ.	DEFECT OF VITAL POWER.
43 Syncope	43 Fainting.
44 Dyspepsia	44 Indigestion.
45 Hypochondriasis	45 Low Spirits.
46 Chlorosis	46 Green Sickness.

ORDER III.

SPASMI.	SPASMODIC DISEASES.
47 Tetanus	47 Cramp.
48 Trismus	48 Locked Jaw.
49 Convulsio	49 Convulsion.
50 Chorea	50 St. Vitus's Dance.
51 Raphania	51 Spasm of the Joints.
52 Epilepsia	52 Epilepsy.

Order III, continued.

53 Palpitatio . . .	53 Palpitation of the Heart.
54 Asthma . . .	54 Asthma.
55 Dyspnœa . . .	55 Difficult Breathing.
56 Pertussis . . .	56 Hooping Cough.
57 Pyrosis . . .	57 Water Brash.
58 Colica	58 Colic.
59 Cholera . . .	59 Vomiting and Purging.
60 Diarrhœa . . .	60 Purging.
61 Diabetes . . .	61 Excessive discharge of Urine.
62 Hysteria . . .	62 Hysterics.
63 Hydrophobia . .	63 Canine Madness.

ORDER IV.

VESANIÆ.	MENTAL DISEASES.
64 Amentia . . .	64 Idiotcy.
65 Melancholia . . .	65 Melancholy.
66 Mania	66 Madness.
67 Oneirodynia . . .	67 Night Mare.

CLASS III.—CACHEXIÆ.

CACHECTIC DISEASES.

ORDER I.

MARCORES.	EMACIATION OF THE BODY.
68 Tabes	68 Wasting.
69 Atrophia . . .	69 Atrophy.

ORDER II.

INTUMESCENTIÆ.	SWELLINGS.
§ 1. *Adiposæ.*	§ 1. *Fatty.*
70 Polysarcia . . .	70 Corpulency.
§ 2. *Flatuosæ.*	§ 2. *Flatulent.*
71 Pneumatosis . .	71 Emphysema.
72 Tympanites . . .	72 Drum-belly.
73 Physometra . . .	73 Air in the Uterus.
§ 3. *Aquosæ.*	§ 3. *Dropsical.*
74 Anasarca . . .	74 Dropsy of the Integuments.
75 Hydrocephalus . .	75 „ Head.
76 Hydrorachitis . .	76 „ Spine.
77 Hydrothorax . .	77 „ Chest.
78 Ascites . . .	78 „ Belly.
79 Hydrometra . . .	79 „ Uterus.
80 Hydrocele . . .	80 „ Testicle.
§ 4. *Solidæ.*	§ 4. *Solid.*
81 Physconia . . .	81 Fleshy Tumour in the Abdomen.
82 Rachitis . . .	82 Rickets.

ORDER III.

IMPETIGINES.	CUTANEOUS DISEASES.
83 Scrophula	83 King's Evil.
84 Syphilis	84 Venereal Disease.
85 Scorbutus	85 Scurvy.
86 Elephantiasis	86 Legs swelled like an Elephant's.
87 Lepra	87 Leprosy.
88 Frambœsia	88 Yaws.
89 Trichoma	89 Plaited Hair.
90 Icterus	90 Jaundice.

CLASS IV.—LOCALES.

LOCAL DISEASES.

ORDER I.

DYSÆSTHESIÆ.	DISEASES OF THE SENSES.
91 Caligo	91 Blindness.
92 Amaurosis	92 Gutta Serena.
93 Dysopia	93 Bad Sight.
94 Pseudoblepsis	94 False Vision.
95 Dysecœa	95 Deafness.
96 Paracusis	96 Wrong Hearing.
97 Anosmia	97 Loss of Smell.
98 Agheustia	98 „ Taste.
99 Anæstheaia	99 „ Touch.

ORDER II.

DYSOREXIÆ.	DEPRAVED APPETITES.
§ 1. *Appetitus Erronei.*	§ 1. *False Appetites.*
100 Bulimia	100 Voracious Appetite.
101 Polydipsia	101 Thirst.
102 Pica	102 Depraved Appetite.
103 Satyriasis	103 Incontinence in Men.
104 Nymphomania	104 „ Women.
105 Nostalgia	105 Longing for Home.
§ 2. *Appetitus Deficientes.*	§ 2. *Defective Appetites.*
106 Anorexia	106 Bad Appetite.
107 Adipsia	107 Want of Thirst.
108 Anaphrodisia	108 Impotence.

ORDER III.

DYSCINESIÆ.	DEPRAVED MOTIONS.
109 Aphonia	109 Loss of Voice.
110 Mutitas	110 Dumbness.
111 Paraphonia	111 Bad Voice.
112 Psellismus	112 „ Utterance.
113 Strabismus	113 Squinting.
114 Dysphagia	114 Difficult Swallowing.
115 Contractura	115 Contraction.

ORDER IV.

APOCENOSES.	INCREASED DISCHARGES.
116 Profusio	116 Flow of Blood.
117 Ephidrosis	117 Sweating.
118 Epiphora	118 Flow of Tears.
119 Ptyalismus	119 „ Saliva.
120 Enuresis	120 Incontinence of Urine.
121 Gonorrhœa	121 Clap.

ORDER V.

EPISCHESES.	OBSTRUCTIONS.
122 Obstipatio	122 Costiveness.
123 Ischuria	123 Suppression of Urine.
124 Dysuria	124 Difficult discharge of Urine.
125 Dyspermatismus	125 „ „ Semen.
126 Amenorrhœa	126 Stoppage of the Menses.

ORDER VI.

TUMORES.	TUMOURS.
127 Aneurisma	127 Aneurism.
128 Varix	128 Dilated Vein.
129 Ecchymoma	129 A Livid Swelling.
130 Schirrus	130 Hardened Tumour.
131 Cancer	131 Cancer.
132 Bubo	132 Glandular Tumour.
133 Sarcoma	133 Fleshy Tumour.
134 Verruca	134 Wart.
135 Clavus	135 Corn.
136 Lupia	136 Wen.
137 Ganglion	137 Swelling of a Tendon.
138 Hydatis	138 Hydatids.
139 Hydarthrus	139 White Swelling.
140 Exostosis	140 Tumour on a Bone.

ORDER VII.

ECTOPIÆ.	PROTRUSIONS.
141 Hernia	141 Rupture.
142 Prolapsus	142 Protrusion Uncovered.
143 Luxatio	143 Luxation of a Bone.

ORDER VIII.

DIALYSES.	SOLUTIONS OR DISUNION.
144 Vulnus	144 Wound.
145 Ulcus	145 Ulcer.
146 Herpes	146 Tetters.
147 Tinea	147 Scald Head.
148 Psora	148 Itch.
149 Fractura	149 Fracture.
150 Caries	150 Caries.

PRACTICE OF MEDICINE.

HEADS OF PRINCIPAL DISEASES TREATED OF.

INFLAMMATION.

FEVERS.

INTERMITTENTS.
REMITTENTS.
CONTINUED FEVERS.
Synocha.
Typhus.
Synochus.
HECTIC FEVER.
ERUPTIC FEVERS.
Scarlatina.
Rubeola.
Variola.
Varicella.
Miliaria.

DISEASES CONNECTED WITH THE DIGESTIVE SYSTEM.

Aphthæ.
Cynanche Tonsillaris.
   „ Maligna.
   „ Pharyngea.
Dyspepsia.
Hæmetemesis.
Colica.
Vermes.
Peritonitis.
Gastritis.
Enteritis.
Diarrhœa.
Dysentery.
Cholera Morbus.
Hepatitis.
Icterus.
Splenitis.

DISEASES OF THE RESPIRATORY ORGANS.

Catarrhus.
Bronchitis.
Laryngitis.
Croup.
Pertussis.
Pneumonia.
Pleuritis.
Hæmoptysis.
Phthisis.
Asthma.

DISEASES OF THE CIRCULATORY SYSTEM.

Angina Pectoris.
Carditis.

DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

Meningitis.
Phrenitis.
Hydrocephalus.
Apoplexia.
Paralysis.
Tetanus.
Epilepsia.
Chorea.
Hysteria.

DISEASE OF THE SKIN.

Erysipelas.

DISEASES OF THE URINARY AND GENITAL ORGANS.

Nephritis.	Hæmaturia.
Cystitis.	Chlorosis.
Hysteritis.	Menorrhagia.

DISEASES PRINCIPALLY ATTACKING FIBROUS AND SYNOVIAL MEMBRANES.

Podagra.	Rheumatismus.

HYDROPES.

Anasarca.	Hydrothorax.
Ascites.	

INFLAMMATION.

The signs of external inflammation are pain, heat, redness, and swelling.

Internal inflammation is judged of by the local pain increased upon pressure; the functional disorder and general derangement of the system; and the blood, when drawn, is generally more or less buffy.

The exciting causes are mechanical and chemical irritants, cold, and poisons.

The pain in inflammation is produced by pressure or distension of the nervous filaments, which probably possess at that time a greater degree of sensibility.

The heat may depend upon the increased quantity of blood in the part, the rapidity of the changes which take place in the blood, and some peculiar power of the nerves.

The redness is occasioned by the accumulation of the blood in vessels which previously carried only the colourless parts of the blood, or red globules in less number. It is the opinion of some, that the red particles do not enter vessels which did not contain them previously, but that in a healthy state they passed through these same vessels in smaller number, so as not to be distinguishable by ordinary observation; and that, in disease, they enter in larger number.

The swelling is effected by the accumulation of blood, and the effusion of serum or lymph, into the surrounding cellular tissue; the action of the absorbents being, at the same time, somewhat suspended.

Inflammation terminates by resolution, effusion, induration, suppuration, ulceration, and gangrene.

Resolution implies a subsidence of the inflammation, without any apparent organic alteration.

In suppuration a new fluid named pus is formed. Its formation internally is preceded by rigors, the pain becomes of a throbbing kind; there is a sensation of weight in the part: when it is formed, the pulse continues frequent, but is softer and more compressible; night sweats and hectic fever often supervene.

In ulceration, there is an increased action of the absorbent vessels, which removes a portion of the living solids. This process is of service in separating the dead from the living parts.

When gangrene or sphacelus takes place, it is known by the sudden cessation of pain, a sinking irregular pulse, a cadaverous countenance, and delirium; where it occurs externally, the parts which were red become livid, and of a dark dusky colour, vesications take place, and there is a peculiar fœtor given off from the body. Gangrene and sphacelus are terms often employed to distinguish two degrees of mortification: gangrene is used to imply that a part is dying, but recoverable; sphacelus means that a part is totally deprived of vitality.

FEVERS.

General Character of Fevers.—There is, at first, a sensation of chilliness with cold surface, probably dependent upon internal congestion, succeeded by increased heat, a full pulse, a flushed countenance, thirst, debility, languor, and pain in the limbs, loss of appetite, nausea, vomiting, and restlessness. The tongue is furred, and the different secretions are disordered.

Cullen divides fevers into idiopathic and symptomatic; some others arrange them in five classes, consisting of intermittents, remittents, continued fevers, hectic fevers, and fevers with eruptions.

Fevers may depend upon four principal causes: first, inflammation of an acute or subacute character in some viscus or tissue of the body; secondly, upon some functional derangement without evident inflammation; and thirdly, upon mere loss of balance of the circulation; and fourthly, upon a vitiated condition of the blood.

Intermittents.

Intermittents are diseases in which there are distinct paroxysms of fever, between which there is an apparently perfect intermission, or period free from fever.

There are three general kinds of intermittents, the *quotidian*, *tertian*, and *quartan*. Besides these, several varieties of an irregular type, which are named irregular tertian, quartan, &c.

In the *quotidian*, the febrile paroxysm recurs daily in the morning, and is in general the longest.

In the *tertian*, the paroxysm takes place every second day, towards the forenoon. The hot fit is generally the longest.

In the *quartan*, the paroxysm recurs every third day in the afternoon. The cold stage is the longest and most violent.

The average duration of a paroxysm is about six hours.

Causes of Intermittents.—The predisposing causes are, cold, combined with moisture, debility of the system from low diet, fatigue, preceding disease, and anxiety of mind. The common *exciting* cause is considered to be the effluvium from marshy soils, called *marsh miasm*, which may be produced by the putrefactive process going on in vegetable substances.

The paroxysm of an intermittent is distinctly marked by three stages: the cold, the hot, and the sweating.

In the *cold stage*, a sensation of cold is first felt in the extremities, and subsequently extends over the whole body; the blood leaves the surface; there is a pale constricted skin, great languor, and listlessness, hurried respiration, oppression at the præcordia; diminished secretions; a small, frequent, and sometimes irregular pulse; the teeth chatter, the limbs tremble, and there is a convulsive shaking of the whole body.

The duration of a cold stage is variable, but may last from one to four hours.

Hot Stage.—After an uncertain space of time, reaction comes on, with heat, which gradually extends over the whole body. The sensibility, from being as it were benumbed, becomes acute; the pulse is quick, strong, and hard; the tongue white; the urine scanty and high coloured; there is nausea and vomiting, confusion of intellect, and sometimes delirium. The duration of this stage is generally longer than the preceding.

Sweating Stage.—After an uncertain time, a moisture breaks out upon the face and neck, and by degrees extends over the whole surface. The febrile symptoms gradually diminish; the pulse becomes natural; the feeling of weakness goes off; the heat of the skin, thirst, and headache diminish; the appetite returns, and the secretions are restored to their healthy condition.

In the cold stage, the symptoms produced may be referred to the accumulation of venous blood in the vessels of the brain, the heart, lungs, and abdominal viscera. In the hot, the heart becomes excited after congestion, producing febrile symptoms, which are relieved in the sweating stage by the blood separating a portion of its thinner parts, forming the profuse perspiration, which may be of great service in cooling the surface of the body.

The accumulation of the blood in the large vessels and deep-seated organs is explained in two ways: some attribute it to a weakened passive state of those vessels and organs which are unable to relieve themselves from the accumulation; others, and amongst them the late Dr. Mackintosh, consider that the congestion arises from an active condition of system, viz., the capillaries becoming unusually contracted, almost spasmodically, refuse to admit the blood to the surface of the body. When this contraction ceases, from the withdrawal of sufficient stimulus, the blood re-enters the vessels, and the heart and lungs being relieved from the surplus, begin to act with increased impetus, and thus occasion the hot stage.

Treatment of Intermittents.—In the treatment of these fevers there are two objects in view; the one, by palliative means, to modify and shorten the paroxysms; the other, which is curative, to prevent their return. The indication in the cold stage, is to restore the natural warmth to the body, to shorten the paroxysm, and to bring on the hot stage. This is usually attempted by applying heat externally, giving stimulants and diaphoretics, using the footbath, and by warmly covering the patient up in bed.

Another mode of treatment, suggested and practised by Dr. Mackintosh, consists of bleeding in the cold stage, by which means an immediate relief of the urgent symptoms is felt, and the paroxysm is often entirely suspended. This mode of treatment is said to have been even successful where all other remedies have failed, and is most likely to do good in robust individuals, and where there is not settled organic disease. The quantity of blood necessary to be drawn varies considerably, viz., from four to twenty ounces.

In the hot stage, means should be employed to lower the temperature. Cold acidulated drinks may be administered, the body may be sponged with cold water, and the greater portion of the bedclothes removed. Bleeding may become necessary, in case of any local determination or inflammation.

In the sweating stage caution is required not to allow the body to be chilled too suddenly, and it is generally desirable to keep up the perspiration till the painful or uneasy sensations are mitigated.

Treatment during the Intermission. — At this period, various vegetable and mineral tonics are administered, to prevent the recurrence of the paroxysm.

The vegetable tonics used for this purpose are *cinchona*, *simaruba*, *cascarilla* bark, and many others.

The cinchona is most efficacious, and seems to possess a specific property in arresting the paroxysms. The least common at present, but oldest form of administering cinchona, is in powder; a drachm to two drachms may be given every three or four hours, so that nearly two ounces may be given during the intermission. The sulphate of quinine is the most eligible form for administering cinchona, as it is less liable to oppress the stomach or irritate the bowels. It may be given in doses of two or three grains every fourth hour, for twenty-four hours before the expected accession; but some prefer a single large dose of from ten to thirty grains, given a little time before the paroxysm.

Should there be any inflammatory diathesis, or local inflammation, bleeding and purging must be had recourse to before cinchona is admissible, or likely to be useful.

When intermittent fever exists, combined with great debility and without local inflammation, wine, opium, and cordials may be administered.

The liver and spleen are found to be frequently disordered in this disease; the spleen is liable to become enlarged, and is then known as the *ague cake*. There is often torpor of the liver, which requires the use of mercurials, for, indeed, in some cases, bark completely fails, until the disorder of the liver is attended to.

The mineral tonics used in the cure of intermittents, are arsenious acid, sulphate of zinc, and sulphate of copper. Fowler's solution, *i. e.*, liquor potassæ arsenitis, may be given in doses of from five to ten minims, but should never be tried until the cinchona in its various forms has completely failed; for this remedy, although it may remove the ague, is apt to injure the stomach, and derange the system generally.

Remittent fevers likewise arise from malaria in many instances. They have no apparently perfect intermission, but have evident periods of paroxysms, or exacerbations.

The principal disease of this description is the yellow fever of hot countries. It is usually attended with symptoms indicating disease affecting the brain, lungs, or abdominal viscera. There is violent vomiting, consisting at first principally of bile, afterwards of dark matter resembling coffee-grounds. The skin and conjunctiva are of a yellow tinge, and there are violent cramps in the belly and legs.

The treatment most efficacious consists in bleeding at the commencement, afterwards applying blisters and counter-irritants, and sponging the body with vinegar and water. Some condemn bloodletting in toto, and place reliance upon large doses of quinine and calomel. Brandy and wine are sometimes administered with apparent success.

There is a form of fever, which attacks children, generally between the ages of three and ten, known as *infantile remittent fever*. Much has of late been written and said on the subject, but still medical men are divided in their opinions respecting the pathology of it. Its symptoms are, debility, hurried pulse, fever with exacerbations, dry skin, furred tongue, restlessness, starting in sleep, tumid abdomen, pallid and emaciated countenance, torpid state of the secretions and evacuations. It sometimes lasts for many weeks, is attended with danger, and often appears to lay the foundation of some organic disease. It is occasionally produced by worms, most commonly by stimulating or indigestible food, and sometimes connected with disease of the mesenteric glands. The most prominent morbid appearance is inflammation and its consequences in the gastro-enteric mucous membrane. The treatment most practised consists in frequent administration of purgatives to clear out the primæ viæ. Mild mercurials should be amongst the remedies; fomentations to the abdomen, the foot-bath, or general warm bath, are useful; bloodletting is seldom necessary, but must be had recourse to in any case of decided local inflammation, especially the application of leeches upon the abdomen; in the latter stages the patient is to be supported by vegetable and mineral tonics.

IDIOPATHIC OR CONTINUED FEVERS.

Synocha, Inflammatory Fever.

Symptoms.—This fever commences with rigors and lassitude, and is followed by flushings and excessive heat. The pulse is full and frequent, the countenance and eyes suffused. There is pain in some part of the body, frequently in the head or back. The tongue is dry and coated; the urine scanty and high coloured. There is costiveness, excited sensibility, quick respiration, and great anxiety.

The precise seat of disease is very doubtful. Some authors refer it to the brain, but the greater number to the gastro-enteric mucous membrane; in many cases no lesion of either part can be discovered, so that it may be seated even in the capillaries, nervous system, or in the blood itself.

Causes.—Sudden change of temperature, over-exertion, alarm, the abuse of liquors, and the suppression of some usual evacuation.

Treatment.—Blood may be drawn from the arm, or locally, according to the age and strength of the patient and violence of the fever. Emetics may be administered, and be followed by purgatives, especially the saline ones. Counter-irritants may be applied; and the medicines to be given for a continuance should be cool drinks, acetate of ammonia, antimonial preparations, and in some cases Dover's powder. Great relief is sometimes experienced by sponging the body with cool vinegar and water. This is only admissible when there is excessive heat, without any apparent local congestion or inflammation.

Congestive or Typhus Fever.

Symptoms.—At first, languor, chilliness, and depressed spirits, with sighing and oppression in the breathing, followed by pain in the head, or some other part of the body; confusion of thought; vomiting; pulse quick and weak, sometimes intermittent; the tongue becomes dry, brown, and tremulous; the countenance is expressive of anxiety, and the cheeks are often tinged with a circumscribed blush; urine pale, watery, and in small quantity; muttering delirium; subsultus tendinum; sometimes diarrhœa, and involuntary excretions; and cold extremities. Exacerbations are generally observed in the evening, and relief is experienced in the morning. A change in the state of the patient, named the *crisis*, is often observed about the fourteenth day from the onset of the rigors; this may be protracted to the twenty-first day, but it is not common. The change which occurs, is perspiration, breaking out about the face and neck, and next day on the arms and other parts of the body, the sordes separate from the gums, the tongue becomes moist, the mind is collected and composed, and the pulse is softer and fuller. The feeling of debility is more perceptible by the patient at this period than before, when he was almost unconscious of his existence; this critical period is ridiculed by many, but I am inclined to think that if it were more properly distinguished, there would be less contradiction in the methods of treating typhus fever.

Causes.—Powerful affections of the mind; exposure to cold and moisture; excessive fatigue, and contagion.

Treatment.—In the commencement give an emetic, to unload the stomach, remove the congestion, and equalise the circulation. In some cases, where there is much pain about the head, apply about eight or ten leeches to the temples; let the head be shaved, and apply cold evaporating lotions; apply a blister to the nape of the neck, or to any part where more indicated; give diaphoretics and mild purgatives, and sponge the body with vinegar and water, if the skin be very hot and parched. The horizontal posture must be insisted upon, and the patient should be restricted to light amylaceous drinks, until the pulse becomes feeble, when beef-tea and stimulating drinks will be decidedly necessary.

Amongst the various plans of treatment I may mention the following:

Some give mercurials to salivation, and say that whoever loses a patient with typhus without having salivated him, may accuse himself of causing the death of the patient.

Some treat the disease by active bleeding, and the use of tartar emetic.

Others treat typhus by wine and other stimulants, even from the earliest periods.

Others rely upon the saline remedies, which were advocated by Dr. Stephens in cholera.

I believe that mercury in moderation is useful; that local bleeding and antiphlogistics do good at the commencement, and that wine may support the heart's action when it fails, and afford time for the beneficial operations of nature and art. Effervescing salines are very refreshing in the early stage, and an excess of alkali appears to give relief, possibly by neutralising some free acid in the stomach.

When the violence of the symptoms has abated, cinchona, serpentary, and other tonics, and opium, to procure sleep, are requisite.

Morbid Appearances.—The most frequent morbid changes observed are in the mucous coat of the stomach and bowels, particularly the ilium. The membrane is softened, the vessels are gorged with blood, the mucous follicles inflamed, and often ulcerated. The brain is sometimes softened, and its vessels unusually filled with dark blood; the pia mater and arachnoid have been seen thickened, and fluid is found sometimes in the ventricles. The lungs are often gorged with blood, and the bronchial tubes present an inflammatory appearance.

From the fact that fever cases exhibit varieties at different seasons and localities, some being attended with indications of gastro-enteric inflammation, accompanied with diarrhœa and sanguineous discharges, whilst in others there was constipation throughout, some physicians of the present day completely separate typhus from typhoid fever contending that they are distinct diseases, and demand different treatment, and they affirm that typhoid fever is the more dangerous of the two, according to this doctrine.

Typhus fever is of the low asthenic kind, dependent upon some poison in the blood, lasting usually about fourteen days. It is more contagious or infectious than typhoid. At the commencement of the second week mulberry-coloured spots show themselves upon the body and limbs, gradually fading, but leaving behind a dusky mottled appearance on the skin. The treatment should be supporting from the commencement.

In *typhoid* fever there is often diarrhœa, with discharge of blood from the bowels, tenderness over the abdomen, especially in the right iliac region, dependent upon inflammation and ulceration progressing in the glandulæ aggregatæ. The fever lasts longer, probably three weeks. The rash comes out later, in rose-coloured spots about the body, which soon disappear, but may reappear. The disease is looked upon by many essentially as a gastro-enteric inflammation. In fatal cases ulceration of the bowels is generally discovered, and sometimes perforation. The remedies used are sometimes leeches over the painful parts, mild alterative mercurials, light astringents to check the purging, and Dr. Ward has found acetate of lead with opium useful in some cases. The diet should be light, and, according to the debility, more or less supporting.

Typhus Gravior, Putrid Fever.

Symptoms.—The same as in typhus mitior at first, but run through their stages more rapidly. Symptoms of malignancy soon appear. The tongue is covered with a brown or black crust; the fæces pass involuntarily; hæmorrhage breaks out; petechiæ show themselves; the pulse sinks and intermits; the skin is cold; hiccup comes on, and death follows. When the symptoms of prostration come on, stimulants are necessary; the best are sulphuric ether, ammonia, wine, and brandy.

Synochus, or Mixed Fever.

The symptoms are the same as in synocha at the commencement, but in the latter stage resemble typhus.

The treatment must partake of that necessary for both forms of fever; refrigerants and evacuants are necessary in the commencement; but, in the advanced stage, the warm bath, stimulants, &c.

This form of fever is very common, and is in many cases the disease which passes under the name of typhus.

Hectic Fever.

The state of body called hectic fever is a concomitant of other diseases, and generally of those in which suppuration has taken place. It is considered by some to be produced by the absorption of pus, and by others to be dependent upon inflammation and ulceration of mucous membrane, when occurring during the progress of other diseases.

Symptoms.—Rigors, mostly towards the evening, followed by heat, and succeeded by profuse perspiration, which may be brought on by any over-exertion. The perspiration is most profuse in the night, and is called night sweats. The pulse and breathing are both very much hurried. There is a redness on the cheek, called hectic blush, and diarrhœa is a very common attendant. In this state, the tongue is generally red, without any fur; its cuticular covering seems to be removed in patches, and the appearance has been likened to raw beef.

Treatment.—Little can be done to remove this fever without at the same time removing the cause. The perspiration may be checked by mineral acids, and the diarrhœa restrained by astringents and opiates.

Exanthemata, Eruptive Fevers.

Scarlatina.

Scarlatina is described by Cullen and others as of three kinds, *simplex*, *anginosa*, and *maligna.*

The first is the mildest form of the disease; the second is attended with symptoms of sore throat; and the third assumes a typhoid or congestive character.

Symptoms.—In the commencement there are slight rigors, followed by pyrexia, with full and frequent pulse. On the second or third day an eruption shows itself upon the skin, commencing about the face and neck; it is diffused in broad patches, and nearly of the colour of a boiled lobster; it is generally very conspicuous about the bends of the arms and elbows, and if closely examined exhibits slight papular elevations, and occasionally small vesicles. The conjunctiva is red; the tongue furred, dry, and red at the edges, and the papillæ are raised upon it. The eruption lasts a few days, and generally terminates in desquamation. In scarlatina anginosa, there is ulceration of the fauces and tonsils. There are very few cases in which the tonsils are not affected in some degree, and it often happens that the medical man is sent for in the early period of the disease to treat a sore throat, which he will know by experience is a prelude of the eruption.

Scarlatina is accompanied by some inflammation of the mucous membranes, and is sometimes followed by anasarca.

Treatment.—In mild cases, simple antiphlogistics are all that is required. If inflammation of any part supervenes, local bloodletting may be had recourse to, and, in some cases, followed by a blister. The patient should be kept at a temperate heat, take cool drinks, and abstain from all stimulants. Laxatives are of great service, and great relief is sometimes experienced by sponging the body with tepid water. When gargles are necessary, warm water forms one of the best, and is of great use when its vapour is inhaled by the mouth. In scarlatina maligna, the hydrochloric acid gargle, or one with liquor sodæ chlorinatæ, are much approved of; a combination of chlorate of potash with dilute hydrochloric acid in draughts, seems to possess valuable properties.

The dropsy, which sometimes follows, generally requires bloodletting, in addition to purgatives and diuretics.

There are no distinct morbid appearances diagnostic of this disease. We find sometimes inflammatory appearances about the stomach and intestines, the lungs and bronchial lining; and inflammation and ulceration about the pharynx and fauces.

Morbilli or Rubeola, Measles.

Symptoms of the common inflammatory form: pyrexia, cough, hoarseness, dyspnœa, wheezing, sneezing, coryza, and drowsiness. On about the fourth day an eruption of dingy red prominent spots, arranged in patches, with rather crescentic margins, show themselves about the face and neck, and gradually spread over the whole body; small red spots are also observed upon the palate. In three or four days more the eruption begins to disappear, and sometimes leaves some desquamation of the cuticle.

This disease, which is always accompanied by some degree of inflammation of the pulmonary system, is liable to assume a congestive or typhoid form, and consequently becomes highly dangerous.

The varieties of measles are four, viz.:

Rubeola vulgaris.
" *sine catarrho.*
" *nigra.*
" *putrida.*

The first is the form just described.

The rubeola *sine catarrho* is a masked variety. The eruption has a more livid hue; there are less inflammatory symptoms, and there is generally little danger.

The rubeola *nigra* is more alarming, for it occurs in ill-fed, half-starved persons, and is attended with considerable congestion of the lungs, which impedes the free decarbonization of the blood.

Rubeola *putrida* is most dangerous, as it occurs in weakly bodies, and prostrates the powers very rapidly, developing symptoms of a typhoid character; very few attacked by it escape.

Diagnosis.—Measles is distinguished from scarlatina by the colour of the eruption, the coryza, the spots are more elevated, and present crescentic margins, and are not arranged in patches of so large a size; the throat is likewise not so often attacked, and the tongue does not present the strawberry appearance so remarkable in scarlatina.

Treatment.—Keep the patient in a mild temperature;

give diaphoretics, refrigerants, and saline purgatives. If the local symptoms run high, bleed generally and locally; if the chest be much oppressed, a blister may be applied after bloodletting, and ipecacuanha in small doses will be found very useful.

If the patient be thin, or much depressed by the disease, great care will be required with a blister. It should only remain on long enough to redden the skin, and not to produce decided vesication, as in other cases.

If the eruption leaves the surface, congestion and inflammation of the brain, pulmonary or abdominal viscera, may be apprehended; the eruption may sometimes be restored by having recourse to the warm bath, and stimulants rubbed upon the body.

Rubeola is very often followed by bronchial inflammation, and an inflammatory state of the mucous membrane of the bowels, producing diarrhœa.

In this diarrhœa, astringents and stimulants are improper. It is better to apply leeches to the anus or abdomen, followed by fomentations; to use the warm bath, administer demulcents and mild saline medicines, and give ipecacuanha in small repeated doses.

There are other sequelæ of this disease, and indeed also of scarlatina, such as enlargement and inflammation of the glands of the neck; in scarlatina, there is often inflammation of the parotid, which arises from the absorbent vessels of the tonsils communicating with those of the parotid gland. Dormant phthisis is likely to be hurried into action, and the mucous membrane may continue long in an unhealthy state.

The *morbid appearances* in case of death from this disease, are such as might be expected from the history and symptoms, viz.: pulmonary congestion, bronchial inflammation, with much fluid in the tubes; inflamed state of the mucous membrane of the bowels, with occasionally ulceration.

Roseola is a disease which is by some likened to measles; it is of a mild character, and is ordinarily of short duration. The varieties [of it are detailed in works on cutaneous diseases. It may be distinguished from measles by more frequently attacking the lower extremities first, by the eruption being simultaneous with the fever, by the less degree of fever, and less constitutional disturbance.

For its cure it requires mild purgatives and antiphlogistics.

Variola, Smallpox.

Symptoms.—This disease commences with rigors, and pain referred to the back and epigastrium; there is uneasiness at the stomach, with retching and vomiting; the eyes are redder than natural; the tongue is covered with a white fur; there is a hot skin and quick pulse; convulsions in this stage are very common in children, especially when the disease is likely to be severe and confluent. On the third day an eruption shows itself, and gradually spreads over the whole body. About the fifth day vesicles form in each spot; in a day or two the vesicles lose their elevation, and a puriform fluid is effused in each. They are surrounded by a red areola, and there is great tumefaction of all the parts affected, especially the face. About the eighth or ninth day the pustules are completely formed, and about the twelfth day they begin to dry up, which change is called desiccation.

Thus the eruption may be said to have three stages—*papular*, *vesicular*, and *pustular*.

The eruption, in severe cases, is followed by pitting, resulting from a loss of substance in the rete mucosum and cutis vera. A slough is said to have been thrown off in each of such spots.

Secondary fever sometimes comes on, and is generally occasioned by an overloaded state of the bowels, and the cessation of the cutaneous discharge.

There are two forms of smallpox commonly described, the *distinct* and *confluent;* in the first the pustules are separated, in the latter they run one into the other.

Diagnosis.—This disease can only be mistaken for varicella, from which it is distinguished by the pustules presenting the central depression; by being of longer duration; and the areola being more red, larger, and more raised.

The *sequelæ* of this disease are inflammation of the conjunctiva, ophthalmia tarsi, which is very tedious and troublesome, swelling and inflammation of the glands of the neck, bronchial affection and disease of the lungs stirring up phthisis in scrofulous subjects, and abscesses forming in various parts of the body.

Post-mortem Appearances.—Turgidity of the vessels of pia mater, with an opacity of the arachnoid and fluid in the ventricles, pustules on the tongue, ulcers in the throat, inflamed state of the bronchial tubes, which contain much fluid, and an inflammatory state of the mucous membrane of the alimentary canal.

Treatment.—The treatment is the same as for fevers in general: in some cases general and local bloodletting are necessary, and the room should be cool and well ventilated. To prevent the marks which usually follow, it is recommended to open the pustules on the face early, with the point of a lancet, to keep the patient in a dark room, to apply cold lotions to the face, and lastly to touch the surface of each pustule with a solution of nitrate of silver.

Varicella, Chicken-pox.

Symptoms.—Pyrexia, with an eruption of small red protuberances, or vesicles without depression. The fluid in the vesicle becomes white, and, about the third day, straw-coloured; on the fifth and sixth day, the disease begins to subside very fast.

Diagnosis.—It is distinguished from smallpox by the slight fever; the vesicles contain serum on the first day of the eruption; the areola is not so red, and raised; and the vesicles do not present the central depression. No suppuration takes place, and the eruption scarcely remains entire on the fifth day; the vesicles come out irregularly, some showing themselves after others have gone through their stages.

Treatment.—Gentle laxatives, refrigerants, and diaphoretics, proportionate to the symptoms, may be given.

Miliaria, Miliary Fever.

Symptoms.—There is pyrexia, great languor, and depression of spirits, laborious respiration, heat of the body, and a tingling sensation is felt over the skin; there is profuse sweat, of a sour, unpleasant smell. Pimples, about the size of millet-seeds, appear about the body, filled with a whitish serous fluid. In two or three days the vesicles break, and desquamation follows. It is said to be most common in women after lying in, and is supposed to be induced by the excessive heat to which their bodies are exposed by an enormous quantity of clothing.

Diagnostic Character.—The profuse unpleasant perspiration, and peculiar eruption.

Treatment.—Give saline purgatives, admit cool air, and allow only light clothing; it is seldom that more than the mildest measures are necessary.

DISEASES CONNECTED WITH THE DIGESTIVE SYSTEM.

Aphthæ.

Symptoms.—In this disease there are small, pearl-coloured, white vesicles on the tongue, lips, and inner surface of the mouth and throat, proceeding to superficial ulceration, and terminating in exfoliation of the cuticle. In some cases it extends along the entire alimentary canal, producing diarrhœa. The anus appears very often inflamed, and, in females, the vagina. There is almost always some febrile excitement, and there is generally drowsiness as a precursory symptom. This disease is almost confined to infancy, but a similar state occurs in adults and old people, in protracted and dangerous diseases, and is very often a premonitory sign of death.

Treatment.—An emetic may be given, and followed by gentle purgatives. Emollient enemas, containing a few drops of laudanum, occasionally give great relief; where there is much depression, aromatic powder, and wine in small doses, become necessary. Some practitioners apply stimulant embrocations to the abdomen, and rub the mouth with a mixture of borax and honey. The medicine which acts most favorably and safely is rhubarb with magnesia, and a little carbonate of soda. This treatment is applied to the aphthæ of infants.

Cynanche Tonsillaris, Inflammatory Sore Throat.

Symptoms.—Pyrexia, redness and swelling of the tonsils and fauces, sometimes extending to the Eustachian tubes, producing deafness, and affecting the uvula, causing an elongation of it; thus giving rise to an incessant desire to swallow. The deglutition is impeded; the voice is indistinct; and there is dyspnœa and headache; the tongue is much coated; and the fauces occasionally become covered with white specks, which terminate in sloughs. This disease is prone to terminate in ulceration or suppuration.

It is generally brought on by wet and cold, particularly when the digestive functions are disordered.

Treatment.—Bloodletting from the arm is sometimes necessary. Leeches and blisters may be applied externally. An emetic is sometimes useful, but brisk purgatives are requisite in nearly all cases. The vapour of vinegar and water may be inhaled. Scarifying the tonsils early gives great relief, or touching them early with nitrate of silver.

Cynanche Maligna, Putrid Sore Throat.

Cynanche tonsillaris sometimes assumes a typhoid character, resembling that state of the throat which occurs in scarlatina maligna.

Symptoms.—Shivering, anxiety, and great restlessness. The fauces are tumid, and of a deep red colour, interspersed with white specks, which are also found in the mouth. The pulse is quick, but weak, and sometimes irregular; there is pain in the throat; the voice is indistinct, and deglutition very painful; the tongue dry and covered with a dark thick fur; diarrhœa, and great prostration of strength; a papular eruption sometimes breaks out about the neck, of a fiery-red colour, and gradually extends to other parts of the body. The ulceration increases, and extends to the alimentary canal or trachea; gangrene supervenes, and death follows.

Treatment.—At the commencement of the attack, leeches may be applied to the throat, and be followed by a blister; an emetic also has been found serviceable; but as soon as an evident depression of the system takes place, the strength must be supported by stimulants and aromatics, as wine and bark, with cinnamon, and the like. The room should be well ventilated, and all effluvia removed; light nourishment should be administered, and the throat may be gargled with stimulant and astringent gargles, and by such as are considered disinfecting, viz., diluted hydrochloric acid and liquor of soda chlorinate. The disease generally arrives at a crisis about the fifth or seventh day.

Cynanche Pharyngea, Inflammation of the Pharynx.

This disease occupies the parts posterior to the soft palate, which are generally observed very red, and covered with a thick viscid secretion. There is an incessant desire to be spitting or swallowing. Deglutition is exceedingly painful. The treatment is the same as for cynanche tonsillaris, but particular attention must be paid to the bowels. An effusion of lymph in this part is called "Diphtherite."

Diphtheria.

The diseased condition of the pharynx, long known as diphtherite, has been epidemic in England of late, and is now recognised in the schools under the name of *diphtheria*. It is mainly an inflammation of the pharynx, attended with swelling in the parts with effusion of lymph, which may extend to the opening of the glottis. It has proved very fatal in some localities. The treatment most recommended consists in mopping the throat with a pretty strong solution of nitrate of silver, or with liq. sodæ chlorinatæ diluted, night and morning, giving internally chlorate of potash with dilute hydrochloric acid, followed up with quinine and stimulants if necessary, and at the same time supporting the system with plenty of light, nourishing food, especially beef-tea.

Dyspepsia, Indigestion.

Symptoms.—The symptoms of this disease are of so varied a nature, that it is difficult to describe concisely the order in which they occur. There is generally loss of appetite; nausea; headache; depression of spirits; acrid eructations; heartburn, costiveness, or diarrhœa; a small slow pulse; a white furred tongue, and disturbed sleep. The fæces are either very dark or of a clay colour, and very fetid.

Treatment.—The remedies most efficacious are gentle purgatives, such as rhubarb, with small doses of mercury; bitter tonics, such as gentian, cascarilla, and small doses of the aloetic preparations, combined with alkalies, to correct the acidity. The diet should be light and nutritious, and not sufficient to completely satisfy the appetite. Much may be done by gentle exercise, and by attending to the habits and state of mind of the patient.

It is often produced by an abuse of stimulating liquors, and then may be considered to be a subacute inflammatory state of the lining coat of the stomach; in such cases, leeches over the stomach, and hydrocyanic acid with antiphlogistic remedies, generally act best.

Connected with dyspepsia, there are some symptoms which have names, as if they were separate diseases, such as pyrosis, heartburn, and gastrodynia.

Pyrosis, also named *water-brash*, is characterised by the throwing off, or bringing up from the stomach a large quantity of watery fluid, very much to the annoyance and inconvenience of the patient: one of the best remedies for it is the nitrate of bismuth.

Heartburn is a sensation of heat at the stomach with acrid eructations, and a feeling of heat and irritation in the fauces. It is often experienced by those who commit excesses in drink; the best remedies are, calcined magnesia, carbonate of soda, and mild purgatives.

Gastrodynia, or *gastralgia*, is a painful state of the stomach supposed to be neuralgic. The pain extends to the back, causes anxiety and faintness; is attended with headache, flatulence, often constipation, and sometimes eructations of thin fluid, as in pyrosis. There is no single remedy very certain in its operation; the chief thing is to avoid indigestible substances. Some medicines which contain anodyne qualities will relieve, such as lactucarium and hydrocyanic acid; and assistance may be given by stimulating embrocations over the stomach.

Hæmorrhoids. Hæmorrhoidal Flux—Piles.

Symptoms.—Severe pain and inflammation at the anus, with discharges of blood in the motions; frequently protrusion of part of the mucous membrane of the rectum containing hæmorrhoidal veins, greatest relief in the recumbent posture.

Piles are spoken of as blind and bleeding, and the term may be said to apply to four different states, viz.—

Varicose state of hæmorrhoidal veins, with some thickening of the mucous membrane.

A similar state, extending to effusion of blood in the submucous tissue, which may be thickened and form condylomatous projections.

A fungoid state of the mucous membrane, exhibiting a variety of appearances.

A prolapsed condition of the mucous membrane, which becomes indurated, and forms a ring round the anus, and is almost strangulated by the sphincter ani.

The disease is dependent upon inattention to the bowels, habitual costiveness, torpor of the liver, pulmonary disease, and is very common in pregnancy; frequent with persons who sit much, and with the body bent forward.

Treatment.—In the inflammatory stage, apply leeches and fomentations, and afterwards cold lotions, the recumbent posture being resorted to; give mild purgatives, and keep the bowels in rather a loose state. Unguentum gallæ and other astringents are beneficial, and great service is done by clearing out the rectum and colon by the enema syringe every morning, with warm water at first, afterwards reduced down to cold. If hæmorrhage proceeds from vessels higher up, the confectio piperis nigri will be beneficial.

Hæmatemesis, Vomiting of Blood.

Symptoms.—Clotted blood is vomited up of a dark colour, and in very large quantity, often amounting to two or three pints, and this comes on rather suddenly. It is preceded by a sensation of weight and pain at the stomach. On examination, it is seldom that any large vessel is found ruptured. The blood is generally poured out by exhalation or transudation from the vessels.

This disease may be mistaken for hæmoptysis, from which it is distinguished by the blood being brought up by vomiting, being more clotted, and of less florid colour, and not attended with cough, and generally mixed with some undigested food. It is often occasioned by an obstructed circulation of blood through the branches of the vena portæ, consequently the vessels which propel their contents into that vein being overloaded, give rise to the effusion into the stomach. It may also proceed from disease of the spleen, or from ulceration of some parts of the stomach. It is more common in women, and they suffer from it frequently, when the menses cease; or during the menstrual period of life, if the proper discharge be checked; washerwomen are said to be frequent subjects of it.

Treatment.—In plethoric habits bloodletting may be necessary; acids and astringents, in a cool state, should be given, and followed by purgatives. Acetate of lead is sometimes very efficacious; oleum terebinthinæ, in small doses, arrests the hæmorrhage in a wonderful manner. Those who consider the disease to be connected with disorder of the liver, bleed, give calomel largely and repeatedly, and administer purgatives.

Colica, Colic.

Symptoms.—Violent pain in the abdomen, with a twisting sensation about the umbilicus; there is spasmodic contraction of the abdominal muscles; constipation, and sometimes vomiting, with hiccup and flatulent eructation. Colic is distinguished from enteritis and peritonitis by the pain being diminished upon pressure, by the pulse being in a very slight degree affected, and by the absence of much constitutional disturbance.

Another form of colic attacks painters and others who work in lead, and is named *colica pictonum.* In this disease the pain is more constant, and not so diffused, although quite as violent. Constipation is a constant symptom; there is a peculiar appearance in the colour of the countenance, and there is often paralysis of the upper or lower extremities, and a singular blue appearance at the edges of the gums, while they are slightly separated from the teeth.

Treatment.—In common colic, an enema of turpentine, opiates, and castor-oil, with aromatics, may be administered, and hot fomentations may be applied to the abdomen.

In colica pictonum, bloodletting is sometimes necessary, in consequence of inflammation of the mucous membrane of the intestines, which frequently supervenes. The medicines most useful are calomel and opium, castor and croton oils, and turpentine, taken by the mouth, and used as an enema. Cupping over the abdomen is sometimes useful, as well as warm fomentations. Alum also in large doses, in lead colic, is said to do good, and has been used successfully by many eminent practitioners.

Morbid Appearances.—Simple colic never kills, but is presumed to depend upon a morbid spasmodic contraction of the muscular fibres of the intestinal canal. In the colica pictonum many have died; a considerable part of the bowels has been found highly inflamed and ulcerated, with a thickened mucous membrane, and sometimes inflamed patches in the peritoneum.

Ileus.

Symptoms.—Severe pain in the bowels, like colic, with fetid eructations, rapid pulse; then vomiting of offensive fæcal matter ensues; there is obstinate constipation, and more or less fever; it is often fatal in a few days.

Morbid Appearances.—Dilatation of a portion of the bowels, with the part below it contracted and highly inflamed. There is often peritonitis over the part, effusion of lymph, and sometimes gangrene; occasionally there are scirrhous tumours or intussusception.

Treatment.—The chief object is to procure a free passage through the bowels, which is generally impracticable. Various purgatives may be tried, and enemata be introduced; sometimes opium, in large doses, has aided the operation of other remedies.

Intussusception, or the invagination of one part of the bowels in another, is a disease most frequent in children. During life it may be suspected, but not known for certainty; it is most frequent at the junction of the ileum and cæcum. The symptoms resemble those of ileus; but, in addition, there is a desire to go to stool, without any other evacuation than some mucus tinged with blood. It is sometimes fatal in thirty-six hours. On examination after death, the mucous membrane of the invaginated part is found highly inflamed. No medical treatment has been attended with much success, but the same treatment may be pursued as in ileus. Some mechanical practitioners have recommended in this and in ileus the taking of large quantities of metallic mercury, under the idea that it may force a passage; there is no objection to the experiment.

Vermes, Intestinal Worms.

The worms which infest the human intestines are principally of three kinds: the *tænia, lumbricus teres,* and *ascaris.*

The *tænia* is found in the small and large intestines, seldom in children. There are two species of this worm, the *tænia solium* and the *tænia vulgaris.*

The tænia solium, as its name implies, occurs singly, and has long joints. The tænia vulgaris occurs in numbers, not of so great a length as the other; its joints or pieces are shorter, and, relatively to their length, broader; so that this worm is also named tænia lata.

The *lumbricus teres* is found in the small and large intestines and stomach. It somewhat resembles the earthworm, and is occasionally brought up by vomiting.

The *ascaris*, or *oxyuris*, is found chiefly in the rectum, and is principally troublesome to children.

Symptoms produced by Worms.—In children, one of the first circumstances which leads to a suspicion of their existence, is picking at the nose; the face is pallid; there is emaciation of the body, and swelling of the abdomen; a furred tongue, impaired appetite, peevishness, and want of sleep; occasionally there is great pain in the abdomen, with purging, and epileptic fits or convulsions.

Treatment.—Anthelmintics act either by mechanically dislodging the worms, or by exerting some poisonous influence upon them. The best for ascarides, are calomel with scammony or jalap, cowhage, and injections into the rectum of turpentine or decoction of aloes. For the lumbricus and tænia, the best remedy is spiritus terebinthinæ; and, if that should not be used, the male fern-root, the root of the pomegranate, or spigelia marilandica may be tried; and the most recent remedy is kousso.

At the time that the above remedies are used the vegetable tonics should be given, as the existence of worms very generally depends upon a weakened state of the digestive functions. The best mineral tonic to prevent the reproduction of them is the tinctura ferri sesquichloridi.

The diet should be nourishing, and green acid vegetables should be avoided; salt should be freely used with the food, for total deprivation of it is almost certain to be followed by the production of worms, especially in ill-fed persons.

Peritonitis, Inflammation of the Peritoneum.

Symptoms.—Pyrexia; great heat and pain in the abdomen, at first confined to a small spot, but subsequently diffused over the whole surface, which is tense, and so painfully tender, that the weight of the bedclothes is insupportable; the knees are drawn up to take off the tension. The pulse is an uncertain symptom; sometimes it is quick, full, and hard; at other times, slow, soft, and contracted; but its general character is that of being hard, wiry, and incompressible. The tongue is at first white, afterwards brown, and red at the edges. There is generally constipation. The respiration is quick, difficult, and thoracic; but there is seldom much vomiting, unless the peritoneal covering of the stomach be attacked.

Causes.—It is generally brought on by cold, by habitual costiveness, contusions, and wounds, produced by accident or surgical operations, as in hernia, &c.

This disease might be mistaken for enteritis, hepatitis, and splenitis.

Treatment.—The principal part of the treatment consists in bloodletting from the arm, and locally by leeches, which are to be repeated after short intervals, if the disease does not yield. Subsequently, when the violent symptoms abate, gentle laxatives may be given, and soothing enemas be administered. After bleeding, most practitioners rely upon repeated doses of calomel and opium. When the bowels become tympanitic, an enema, containing turpentine, may be thrown up. The regimen must be completely antiphlogistic. Late in the disease, blisters over the abdomen may be applied.

Morbid Appearances.—The small vessels of the peritoneum minutely injected with blood, shreds of lymph covering many parts, and the intestines almost agglutinated together by it; serum in the cavity, with flocculi of lymph in it, and sometimes a considerable quantity of pus. The fluid will be found gravitating towards the pelvic cavity.

A form of peritonitis attacks females after parturition, and is called *puerperal peritonitis*. It differs from the other, inasmuch as it occurs in patients who have for months past been debilitated by the progress of utero-gestation, and more recently by the enfeebling efforts of parturition. It often attacks debilitated constitutions; and, from assuming a masked character, has been generally more fatal than common peritonitis.

The seat of disease is essentially the same; it comes on about the third day, being preceded by alteration or suppression of the lochial discharge, flabby breasts, and acute pain in the hypogastric region; the pain and inflammation soon extend over a considerable portion of the peritoneum.

Treatment.—Bloodletting and calomel are to be mainly depended on in this form of disease. When it is coexistent with congestion or typhoid symptoms, large doses of turpentine are found exceedingly useful.

The morbid appearances are the same as in ordinary peritonitis, excepting that the broad ligaments exhibit traces of high inflammation.

Puerperal Fever is a very dangerous disease, and is generally described under the head of peritonitis. By some observing practitioners, a clear distinction has been drawn between it and peritonitis, such as I will copy from Dr. Waller's excellent work on midwifery.

	Peritonitis.	*Puerperal Fever.*
Pulse,	small and hard, or full and round; seldom exceeding 100, at the onset.	soft and undulating, from 140 to 150 soon after the chill.
Head,	not much affected.	suffers severe pain, sometimes great confusion.
Tongue,	dry and white.	at first natural, afterwards glassy or dark brown.
Secretions,	checked, or entirely suspended.	at first natural, afterwards altering in quantity and quality.
Pain,	superficial.	at first deep-seated and decidedly uterine.
Skin,	hot and dry.	variable, not unfrequently moist and perspiring.

Treatment.—The management of this disease is very difficult, and the recoveries few. Dr. Waller recommends leeches to be applied over the hypogastric region, to be followed by fomentations, and afterwards spirits of turpentine to produce counter-irritation; internally, opium in large doses, with some calomel; and afterwards, the same medicines in smaller quantities, some mild laxative for the bowels, and, if diarrhœa comes on, the use of chalk mixture, with aromatic confection, and confection of opium.

Post-mortem examination exhibits inflammation of the peritoneal covering of the uterus and its appendages, enlargement of the uterus, and, on cutting in it, inflammatory state of the uterine veins, which often contain some pus.

Gastritis, Inflammation of the Coats of the Stomach.

Symptoms.—Pyrexia; thirst, with great desire for cold drinks; great heat and dryness of the skin; pain at the epigastrium, increased upon pressure; retching and vomiting of nearly everything taken into the stomach; the pulse is quick, but small and compressible; there is great prostration of strength; frequent hiccup; the tongue is generally much furred in the centre, with red tip and margins.

Diagnostic Character.—The excessive vomiting, the seat of pain, and great heat of the epigastrium.

Treatment.—The best remedial means are, copious bloodletting, by venesection, and leeches applied to the epigastrium; fomentations, the warm bath, enemas, and, after copious bloodletting, laxatives, demulcents, and diaphoretics; opium may also be given in small doses combined with calomel.

Some pathologists consider the disease to be seated in the muscular coat, others affirm that it always commences in the peritoneum; and as few deaths occur from such a disease, limited to the stomach, it will be very difficult to decide upon the question.

Enteritis, Inflammation of the Muscular and Peritoneal Coat of the Intestines.

Symptoms.—Pyrexia; pain in the abdomen, increased upon pressure, but not so acute as in peritonitis. There is frequently some tension; a weak, contracted, and compressible pulse; great depression and loss of strength; high coloured urine. The tongue is furred, and generally very red at its tip and margins. The pain varies in situation, according to the part affected; if the upper portion of the small intestines is attacked, there will be vomiting, and pain about the umbilicus; if the colon is suffering, there is pain extending along its course, called tormina, and there will often be diarrhœa; when the rectum is the part affected, there is often bearing down, with tenesmus, and evacuation of bloody mucus.

Treatment.—Bloodletting, enemas, &c., may be resorted to, as in peritonitis, and the general treatment will be much the same. Blisters are not very often necessary; but stimulating embrocations over the abdomen may be substituted for them. Laxatives of the mildest kind only are admissible.

Enteritis Mucosa.

The term is applied to an inflammatory state of the mucous coat of the small intestines. The symptoms are variable, but the most prominent are the following, and it may be considered more a symptomatic than idiopathic affection.

Symptoms.—Tenderness of the abdomen increased upon pressure; quick pulse; febrile heat; thirst; considerable debility; the tongue red and smooth; and the lips often inflamed and sore; sometimes an aphthous state of the mouth; there is generally diarrhœa; the stools contain much mucus; some blood, and there is frequently tenesmus.

Treatment.—If the disease be apparently idiopathic, blood may be drawn from the arm, and leeches may be applied over the abdomen. The warm bath and fomentations are useful. The medicines may consist of hydrargyrum cum cretâ, as an alterative, every night; cooling draughts, with a little hydrocyanic acid; copious bland demulcents, and enemata of starch with some opium to relieve the tenesmus, which is often troublesome. Occasional doses of castor-oil or rhubarb may be given to carry off any accumulating portion of hardened fæces. To check excessive purging, decoction of logwood is a mild remedy.

Morbid Appearances.—In fatal cases there is inflammatory redness of the mucous membrane, patches of inflammation, with elevation; sometimes ulceration, softening, and removal of the mucous coat, and in some cases perforation. Gangrene has been seen in a few instances.

Diarrhœa, Looseness.

Symptoms.—Frequent discharges of liquid fæcal motions, with pain and griping; considerable weakness and prostration.

Diarrhœa may depend upon irritation or inflammation of the mucous membrane of the bowels, produced by indigestible food, accumulation of fæces, vitiated biliary secretions, cold, &c. When it depends on any acute inflammation, it may be known by other constitutional symptoms.

Treatment.—The treatment must vary with its causes. If diarrhœa arises from cold, a warm bath is indicated; if it depends upon inflammation of the intestines, bloodletting and leeches will be necessary; if from vitiated bile, accompanied by vomiting, calomel and rhubarb will be useful, followed by small doses of opium; if it is occasioned by acrid indigestible food, the bowels should be relieved by castor-oil, followed by mild astringents and tonics.

As a general rule, the best plan is to give a good dose of calomel and rhubarb, follow that up by a dose of castor-oil; and generally when the bowels have been cleared out, the disease ceases completely; if not, give the chalk mixture, or compound chalk powder, or any of the ordinary routine astringent medicines.

Dysenteria, Dysentery.

Symptoms.—Pyrexia; flatulence; nausea or vomiting; griping of the bowels; frequent inclination to go to stool; tenesmus; frequent evacuations from the rectum of mucus mixed with fæces or blood; sometimes films, like membranes or fat, are passed with portions of indurated fæces; there is great debility.

Treatment.—The remedies to be employed are venesection and leeches, the warm bath, demulcent drinks, antimonials, ipecacuanha; and if there be any suspicion of fæcal matter in the intestines, castor-oil, or rhubarb, with opium, may be given. Counter-irritants may be applied to the abdomen, and a suppository of opium, or starch enemas with opium, may be introduced into the rectum.

The disease is principally seated in the colon and in the rectum.

The *morbid appearances* are an inflamed state of the colon and rectum; the peritoneal covering is sometimes affected; the mucous coat is thickened, raised in parts, as if hypertrophied, round a central depression, resembling an ulcer; sometimes there are ulcerations and perforations of the intestines, which admit the passage of fæcal matter into the peritoneal cavity; and in some cases gangrene.

A chronic form of the disease is met with here, especially in persons who have returned from hot climates. The repeated purgings, with discharges of mucus, even pus and blood, gradually wear down the system, and the sufferers ordinarily present a pale, emaciated, sickly appearance. They are most benefited by light food, the use of laxatives, to keep the motions soft, and the bowels free; by taking mineral tonics, such as sulphate of copper or zinc; alterative mild doses of mercurials may occasionally be given.

The disease is unfortunately but seldom cured.

Cholera Morbus.

Symptoms.—A sensation of heat at the scrobiculus cordis; vomiting and purging of bilious matter; hurried respiration; great depression and anxiety; griping pains in the abdomen; a quick, but small and contracted pulse; excessive thirst; spasmodic contraction of the muscles of the abdomen and extremities. The surface is pale, and exceedingly cold; and the blood, when drawn, is very dark and thick, approaching to a pitchy consistence. There is also suppression of urine.

The *morbid appearances* found on dissection are generally those of congestion of the different viscera. The stomach and intestines are sometimes of a scarlet colour, and there is a copious secretion of thick mucus within them. The urinary bladder is found nearly always contracted.

Treatment.—The means to be used in this disease are pretty generally agreed upon. At the commencement heat should be applied to the surface, to restore the balance of the circulation. Strong stimulants are to be given (as the disease is not one of simple inflammation), and followed by repeated doses of calomel and opium. When the early danger has subsided, light nourishment should be administered, and care taken that reaction does not bring on visceral inflammation.

The *Asiatic* or *Spasmodic Cholera*, is distinguished by the absence of bile in the evacuations from the stomach and bowels. The ejected fluids resemble rice-water. There is almost invariably a purple or blue appearance of the extremities, and a very characteristic expression of countenance, and painful spasms in the extremities and abdominal muscles. The most successful plan of treatment has been that in which the chief reliance is placed on calomel. Salt-water emetics have been highly commended in the very worst forms of the disease. A very favorable symptom in the course of the disease is the appearance of bile in the evacuations.

Hepatitis, Inflammation of the Liver.

Inflammation of the liver is generally seated in and near the peritoneal covering, rarely attacking the central substance itself.

Symptoms of Acute Hepatitis.—Pyrexia, pain felt in the right hypochondrium, increased upon pressure; tongue covered with a yellowish fur; difficult respiration; dry cough; pain is felt in the right shoulder; the urine is high coloured; the pulse is quick and hard. There is gastric irritability and hiccup; if the inflammation be very acute, the secretion of bile is suspended, and the fæces assume a clay colour. The skin also assumes a yellow tinge, and there is a difficulty in lying on the left side, arising from stretching of the ligaments and peritoneal covering occasioned by gravitation of the liver towards the left side.

Morbid Appearances.—Lymph on the surface of the liver, causing adhesions with the neighbouring parts; enlargement, less firmness; it breaks easily with pressure, and generally is very much gorged with blood; sometimes reduced almost to a pulpy state; occasionally there is a large abscess. This abscess of the liver may burst during life, and the patient may recover. The part which allows its escape, and is most favorable, is the abdominal parietes anteriorly; the pus finds its way also into the lungs, through the diaphragm, and into several parts of the intestinal canal; when it bursts into the peritoneal cavity it kills very rapidly, or will set up very extensive peritoneal inflammation, which destroys in a few days.

In *Chronic Hepatitis*, there is a feeling of weight and dragging sensation at the liver, with sometimes a hardness perceptible externally; pain in the shoulder; dyspepsia; sallow countenance; attacks of jaundice; nausea; low spirits; costiveness, and general derangement of the whole system. The pulse is no guide, for it is often weak and slow; sometimes quickened with short attacks of fever. There is in many cases an eruption about the face and shoulders, much of the nature of acne.

Morbid Appearances in Chronic Hepatitis.—These are very variable; we find induration either with enlargement or contraction; granular appearance, either increased or diminished, with an unhealthy disproportion between the red and yellow parts, producing various shades of nutmeg liver, such as is often to be found in drunkards. Parts are seen of a firm texture, and of yellow colour, scattered through the liver, with vessels shooting into them, and raising up the surface of the liver, giving it a lobulated appearance, and this surface often of a green colour.

Treatment.—Take blood away from the arm freely, and apply leeches to the seat of pain. Counter-irritants may be applied. Gentle laxatives and enemas should be administered, and recourse be had to the warm bath. Some practitioners give calomel in large doses, but not so much as formerly, for it appears to be more useful in the chronic form of the disease.

There are many other morbid states of the liver less definite in their symptoms, and scarcely curable, which are described in larger works, such as schirrhus, tubercles, fatty liver, hydatids, &c.

Chronic hepatitis is most relieved by calomel, chalybeate waters, mild purgatives and tonics; iodide of potassium, too, is an excellent auxiliary.

Icterus, Jaundice.

Jaundice arises from some obstruction to the course of the bile, either depending upon inflammation or mechanical pressure upon the minute ducts, or the large duct itself. The causes are generally acute and chronic disease of the liver, increasing or diminishing the flow of the bile; duodenitis; gall-stones obstructing the duct; inflammation, contraction, or spasm of the duct, and mechanical pressure, as during pregnancy, &c.

Symptoms.—Yellowness of the skin, affecting the conjunctiva, and sometimes causing objects to be seen of a greenish colour, occasionally preceded by tingling of the skin. There is often pain in the right hypochondrium; nausea and vomiting; great lassitude and languor; the fæces are white, and the urine high coloured, generally giving a yellow tinge to the linen. The pulse is often rather slower than usual, unless there be hepatic inflammation.

Treatment.—When there is pain in the hypochondrium, leeches should be applied. Emetics are sometimes useful, and may be followed by mild mercurials, laxatives, and the warm bath. The diet should be of the lightest kind. Iodide of potassium is sometimes useful, and gentle outdoor exercise is beneficial.

Gall-Stones.

Gall-stones sometimes attain a considerable size, escape from the gall-bladder, and try to make their way into the duodenum, and in their passage cause much distress.

Symptoms.—Acute lancinating pain in the situation of the gall-ducts, coming on in paroxysms; not much pain externally; the pulse little affected, and not much constitutional disturbance; inflammation is liable to arise; therefore the treatment has to be directed to it.

Treatment.—Give opium in large doses, use the warm bath, bleed from the arm, and try the effect of a relaxing emetic. Some recommend ether, both as an antispasmodic and under an impression that it may act chemically upon the gall-stones; sometimes leeches or cupping glasses over the liver afford relief.

Splenitis, Inflammation of the Spleen.

Symptoms.—Pyrexia; pain in the left hypochondrium, increased upon pressure; difficulty of lying on the affected side; a yellowish tinge of the skin. In chronic splenitis, and frequently in intermittent fever, the spleen is found greatly enlarged, and when examined after death, presents a soft, black, pulpy, appearance, like decomposing blood. The spleen is also liable to become tuberculated both on its surface and within its substance.

Treatment.—Bloodletting, generally and locally; purgatives, warm bath, and counter-irritants, are the remedies to be employed.

In chronic enlargement of the spleen, mercury is used, both internally and externally. Bromide and iodide of potassium are reported to be valuable remedies for its removal.

DISEASES OF THE RESPIRATORY ORGANS.

Catarrhus, Catarrh.

Symptoms.—Sneezing, with increased secretion of mucus from the nose and fauces; pyrexia; cough; pain in the head and chest. Sometimes the inflammation extends down the larynx and trachea, giving rise to copious expectoration. The fluid expectorated generally becomes thicker as the disease declines.

Under the name catarrh, bronchitis of the subacute kind is often described.

Treatment.—Confinement to a warm room, antiphlogistics, the warm bath, and diaphoretics, such as antimonials, and ipecacuanha, and brisk purgatives are to be employed. Bloodletting is seldom necessary.

Bronchitis.

This disease has obtained several names from the different authors who have treated upon it. It is called *peripneumonia notha, catarrhus suffocativus;* and, when in the chronic form, in old people, *catarrhus senilis.*

Symptoms of Acute Bronchitis.—Pyrexia; heat of the skin; dyspnœa, with hurried and laborious respiration;

feeling of roughness or rawness in the trachea; hoarseness; oppression at the præcordia; and dry cough. After a short time there is an accumulation of mucus, giving rise to a wheezing or rattling noise in respiration, known as the râle muqueux. There is a leaden colour of the lips and cheeks, caused by the blood not being properly decarbonized. The pulse is quick, but soft and compressible; there is great prostration of strength, and anxiety; pain and giddiness of the head; sometimes delirium.

Stethoscopic Signs.—At first, sibilus, or sonorous rhonchus; when secretion takes place, the mucous rhonchus, also known as large crepitation; sometimes the mucus plugs up a bronchus, and for a time, the respiratory murmur is lost in the part of the lung which the bronchus supplies; but there is little or no dulness of sound on percussion, which will distinguish this state from hepatization.

Morbid Appearances.—The lungs gorged with blood, sometimes emphysematous on their surface; the bronchial tubes, filled with thick reddish mucus, and often with a fluid of a muco-purulent character; the membrane is highly inflamed; and the same appearances may extend into the trachea. We also find the vessels of the head, liver, &c., congested.

In *Chronic Bronchitis* the expectorated fluid resembles that emitted during the latter stages of the acute form; sometimes it has a purulent appearance, and is often mixed with blood; there are sometimes night-sweats, with emaciation; hurried and short respiration.

Treatment.—Bloodletting, with caution, is necessary; it is very beneficial at the commencement; but, when much fluid has been effused into the bronchi, the strength should not be too much lowered, for fear that there will not be sufficient power in the system to throw off what has been accumulated. The best medicines are emetics and antimonials; counter-irritation should be produced by a blister or tartar-emetic ointment, and purgatives may be given when required.

Laryngitis, Inflammation of the Larynx.

Symptoms.—Pyrexia; a sensation of constriction and pain about the larynx; hoarseness; respiration quick and laborious; anxious expression of the countenance; pulse quick and jerking, and a peculiar shrill noise attends inspiration. There is danger in this disease of serum being effused into the submucous cellular tissue about the upper part of the larynx, known as œdema glottidis, and unless laryngotomy or tracheotomy be performed, the patient will soon be suffocated. This inflammation frequently accompanies smallpox, scarlet fever, and measles.

Morbid Appearances.—The mucous membrane thick and vascular, with numerous small ulcers, rendering its surface irregular; sometimes covered over with a layer of tenacious lymph.

Treatment.—The same as for croup.

Cynanche Trachealis, Croup.

Symptoms.—It generally commences with symptoms of common cold, as hoarseness, which may last almost unnoticed for a few days, till the patient gets gradually worse; the symptoms then become aggravated, often at midnight, when we have them of the following character: pyrexia; difficulty in breathing, attended with a peculiar crowing sound; great anxiety; the face and neck are flushed, but rather livid in appearance; the voice almost inaudible; there is cough, at first rough and dry, subsequently more free, and a viscid glairy matter is expectorated with great pain. This disease generally attacks children between the second and fifth years of their age. When fatal, it terminates mostly about the third or fourth day. The principal cause of death is the formation of a false membrane, which occupies the trachea, and sometimes extends to the larynx and bronchi.

Morbid Appearances.—We find lymph in the trachea, constituting a false membrane in the different degrees, sometimes soft and yielding, partial, or extending the whole length, and even into the bronchi; sometimes it is exceedingly thick, and assumes the form of a perfect tube. The larynx often contains lymph; and the ramifications of the bronchi, and even the lungs, present an inflammatory appearance; the inflammation may extend to the pharynx and œsophagus.

Treatment.—Bloodletting, from a vein, is absolutely necessary at the commencement; leeches are to be applied along the course of the trachea, and upon the sternum; the latter part is preferable. An antimonial emetic should be given, and followed by nauseants, purgatives, and warm bath. In some cases a blister is useful after leeching. Calomel, in large repeated doses, such as two or three grains every hour, is relied upon by some persons. Dr. Cheyne gives a preference to tartarized antimony.

There is another modification or variety of croup known by authors as *Laryngismus Stridulus*, spasmodic croup, or the crowing disease.

Spasmodic Croup occurs in young children during dentition. It is not purely spasmodic, for it is frequently connected with congestion and inflammation of the mucous membrane of the larynx; it is sometimes connected with the cerebral functions, and state of the alimentary canal. It is much milder and less dangerous than real croup, and is often relieved by an emetic, and some purgative medicine. It comes on mostly in the night. The other remedies for it are, the warm bath, lancing the gums, and the application of two or three leeches to the chest.

Pertussis, Hooping-cough.

Symptoms.—A peculiar convulsive cough, coming on in paroxysms, consisting of several hurried expirations, followed by a deep inspiration, which is accompanied by a peculiar noise, named the hoop; this is repeated till the child brings up a quantity of viscid mucus; after which it recovers, either speedily, or may lie down exhausted and fatigued. During the fit of cough, the face is swollen, purple, and livid; the eyes seem starting from their sockets; sometimes a vessel in the conjunctiva gives way, and the eye becomes bloodshot, or there may be epistaxis, hæmoptysis, vomiting, and in some instances a vessel in the head yields, and the child dies suddenly. The duration of this disease averages six weeks; it ordinarily attacks children, and is almost always epidemic. It commences like a catarrh, which lasts from a week to a fortnight before the decided diagnostic symptoms of the disease show themselves. It is very fatal to children, and requires careful management.

Morbid Appearances.—Congestion of the lungs, which are so loaded with blood that they sink readily in water; inflammatory appearance of the mucous lining of the bronchial tubes; sometimes the trachea and larynx contain thick viscid mucus, with lymph and streaks of blood; if the disease be protracted, small red granules are found scattered about the lungs, which are also in parts softened and ulcerated; sometimes there is œdema of the epiglottis, with inflammation in the pharynx; the vessels of the brain are often gorged with blood, and sometimes we find effusion.

Treatment.—In the early stages, if there is oppression of the breathing, with signs of bronchial inflammation, bloodletting is necessary, and often highly beneficial. Tartarized antimony or ipecacuanha should be given almost to nausea, and the bowels should be kept moderately open. In the second stage, and in mild cases, the chest should be protected from cold, and indeed the surface of the body generally. The diet should be light. Counter-irritation upon the chest, by stimulating liniments and tartarized antimony, is useful; and an emetic given daily, or every other day, is serviceable. I have found vinum ipecacuanhæ to answer best; and, if given in the evening, it unloads the stomach, produces some exhaustion, and a quiet night is the result of it. As a general remedy, I have found ipecacuanha, in small doses, with conium and bicarbonate of potash, given three times a day, to answer best. In addition to the measures mentioned above, with some practitioners belladonna and hydrocyanic acid are favorite remedies. Some physicians advocate the use of mineral acids, especially nitric, others advocate the internal use of cantharides, others give alum, but I consider the alkaline treatment in the early period much the most successful. Change of air has the reputation of contributing to the cure.

Pneumonia, Inflammation of the Lungs.

Symptoms.—Pyrexia, hot skin, dyspnœa; there is a sensation of constriction about the chest, painful cough, the pain is more obtuse than in pleuritis, but there is a greater sensation of oppression. The respiration is quick and difficult, and the countenance often assumes a purple colour. The pulse is generally quick and full at the commencement. The expectorated matter is at first muco-sanguinolent, but becomes afterwards thick, opaque, and puriform. When suppuration takes place, it is known by rigors coming on, the pain is more fixed, and there is hectic fever.

Physical and Stethoscopic Signs.—For describing these, the disease is usually divided into three stages.

In the first stage, the râle crepitant is very distinctly heard, together with the usual respiratory murmur; on percussion, the sound is almost as clear as in health, but as the disease proceeds, it becomes gradually more obscure.

In the second stage solidification takes place, and there is no crepitous râle, nor respiratory murmur heard in the part affected; in the sound part of the lung, the respiration is more audible, and is named *puerile.* There is a dull sound on percussion over the affected part. When the lung is diseased near the large bronchi, there is bronchophony.

In the third stage, purulent infiltration takes place, and is known by a mucous râle, and if the pus be accumulated in a part, and afterwards discharged, the cavernous râle and pectoriloquy will be heard when a cavity is left.

Morbid Appearances.—In the first stage, redness from congestion of the vessels, which pour out blood freely, if the lung be cut into; and increase in the weight of the lung. In the second stage, the colour is variable, but never so red as in the first; the lung crumbles or breaks down between the fingers, and crepitation is lost in the part. In the third stage, the lung is hard and heavy, and when cut into and compressed, a quantity of sanguineous gray or purulent fluid is seen to ooze out from several parts. Crepitation also is lost. A distinct abscess is an exceedingly rare occurrence. The pleura often partakes of the disease, and presents many patches of lymph, and some which have produced adhesions. Gangrene has been met with in some very rare instances, and is easily recognised by the black appearance and intolerable fœtor of the part.

Treatment.—Bleed freely from the arm, and locally by leeching and cupping; give brisk purgatives; apply blisters; great reliance may be placed in nauseating doses of tartarized antimony and ipecacuanha. Some practitioners administer calomel with small doses of opium; this treatment is highly proper when effusion has taken place.

Pleuritis, Inflammation of the Pleura.

Symptoms.—Pyrexia, acute pain in some part of the chest, increased by taking a deep inspiration; percussion is painful; there is immobility of the ribs corresponding with the affected part; inspiration is short and catching, but expiration is comparatively slow. The breathing is not so sensibly oppressed as in pneumonia. The pulse is quick and hard, in feel resembling whipcord, which is generally the case when the serous membranes are inflamed. The skin is hot, and the tongue much furred. The expectorated fluid is more watery than that in pneumonia and bronchitis.

Physical Signs.—In the commencement a friction sound is sometimes heard, but afterwards there is often a dull sound on percussion when serous effusion has occurred. The respiratory murmur is diminished and subsequently lost; with slight effusion there is œgophony; if during the disease, œgophony is evident, then ceases with the progress of the disease, and afterwards reappears, it is a favorable symptom. When the effusion is considerable, the affected side is perceptibly enlarged.

Pleuritis terminates in effusion of a yellowish serous fluid, effusion of lymph, forming adhesions between the pleura costalis and pulmonalis; and if protracted may terminate in empyema.

Morbid Appearances.—The pleura is more vascular than natural, with red spots, like ecchymosed blood; underneath the membrane there is deposition of lymph, sometimes in several layers; effusion of serum, with flocculi of lymph in it, such as we find in peritonitis; lymph, agglutinating the pleura costalis and pulmonalis together, by becoming organized; the lung very much compressed, lying close to the spine. Mortification and ulceration of the pleura are extremely rare. Amongst the consequences of pleuritis empyema must be enumerated; but this is by most thought to be a production of a chronic form of pleuritis. The pus also might get into the cavity by the bursting of vomicæ. To remove the fluid paracentesis is performed, which in several cases has effected the cure of the patient. The symptoms accompanying are very much the same as those to be described as belonging to hydro-thorax.

Treatment.—The means to be employed are the same as those necessary for pneumonia. Bloodletting is employed in most cases more repeatedly, and calomel may be more relied upon.

Hæmoptysis, Spitting of Blood.

Spitting of blood brought up from the lungs may depend upon three principal causes, viz., exhalation of blood upon the surface of the lining membrane; rupture of a congested vessel, as in apoplexy of the lungs; and ulceration, or erosion of a vessel of a tuberculous cavity.

Symptoms.—There is a sensation of weight and oppression at the chest; a tickling feel about the larynx, trachea, and bronchi; a dry cough and dyspnœa; a pulse generally full and hard; the tongue is white; a saltish taste in the mouth; and, in a fit of coughing, a quantity of blood is brought up, which is of a florid red colour and frothy, but occasionally black and clotted.

Physical Signs.—In the simplest hæmoptysis, auscultation discovers only a slight mucous râle in the part of the lung affected. The sound on percussion varies little from that in health.

In *Pulmonary Apoplexy* there is dulness of sound over the part affected, the respiratory murmur is wanting, and there is a crepitous râle in the surrounding parts.

Morbid Appearances. — In the first variety, which scarcely ever kills, coagulated blood is found in the bronchial tubes; the mucous membrane is soft, tinged with blood, and its vessels much congested. In pulmonary apoplexy, parts of the lungs are found indurated, and of a very dark colour. This seems to be produced by a gradual deposition of blood into the parenchymatous structure of the lung; and is most common at the posterior and inferior parts. The third variety is attendant upon phthisis pulmonalis, and is usually treated of under that subject.

Treatment.—It is often necessary to take away blood from the arm. The patient should be kept perfectly quiet, and in a cool temperature; he should take cold acidulated drinks, and the diet should be of the mildest nature. The medicines most useful are—purgatives, acetate of lead, sulphuric acid, digitalis, and most of the astringents.

Phthisis, Pulmonary Consumption.

Symptoms.—In the first stage, during the formation of tubercles, there is cough, with slight expectoration, languor, and debility, and a quick and soft pulse. In the second stage, the tubercles being increased, oppress the lungs, producing dyspnœa; hæmoptysis often supervenes at this period. In the third stage, the tubercles are softened, and purulent matter is ejected; there is hectic fever, with night-sweats, emaciation, and purulent expectoration, with some pain. There is frequently a flushed cheek; diarrhœa is a common attendant, and is mostly occasioned by ulceration of the intestines.

The upper lobes of the lungs are more frequently the seat of the disease.

Physical Signs.—In the first stage the stethoscope does not convey much information; the respiration is less perfect in the part affected, there is a slight crepitous râle, and some dulness of sound on percussion.

In the second stage, the tubercles increasing in number, there is a dull sound on percussion; the respiratory murmur disappears; the breathing is bronchial, and there is bronchophony.

In the third stage, that of softening, various sounds are heard, according to the condition of the part, viz., a deep gurgling perceived during coughing; when a communication is formed between a cavity and the bronchial tube, we have cavernous respiration and cavernous rhonchus, and pectoriloquy; if the cavity be very large, amphoric resonance and metallic tinkling. The sounds given by percussion may be clear and loud.

Morbid Appearances.—Adhesion of the pleura to the walls of the chest; the lungs present an uneven, unequally hard surface on pressure; in parts they are more solid than natural, in others soft and yielding; on cutting into them whitish tubercles are scattered over various parts, more numerous in the upper than lower part of the lungs; amongst these, large cavities are seen, either separate or many communicating together, in some places filled with purulent fluid. These cavities contain a thick purulent pulpy fluid, which adheres to the walls: across them fibrous bands are stretched, consisting partly of the obliterated vessels and tissue of the lungs. In the parts surrounding the tubercles, and even occupying an entire lobe, there is tubercular infiltration; sometimes a large cavity has opened into the bag of the pleura, and formed that state of disease named empyema.

In addition to these we notice great emaciation of the whole body, contraction of the chest, serum in the pericardium; the lining membrane of the bronchial tubes thickened and inflamed, and that of the trachea and larynx red and sometimes ulcerated; the mucous membrane of the stomach is sometimes inflamed, thickened, and pulpy; the small intestines, especially the ilium, presenting ulcerations; and there are tuberculous deposits in the mesenteric glands, and many other parts of the body.

Treatment.—The remedies employed are, local blood-letting in small quantity; purgatives, sedatives, acids, rubefacients, and blisters; cod-liver oil is now the favorite remedy, and most assuredly if it fails to cure the disease, it is the means of prolonging life, in many cases in a most marked degree. In the commencement, removal to a warm climate may retard the development of many of the symptoms and progress of the disease; but, when vomicæ have once been formed, there are but slight hopes of any recovery.

Asthma.

Symptoms.—A periodical difficulty of breathing, generally coming on about evening, and diminishing in the morning. There is a sensation of tightness and fulness in the chest. Expiration is accompanied with a wheezing sound. At the commencement of the paroxysm there is very little cough; but towards the end there is a free cough, with expectoration of mucus. The face is much flushed, and of a livid tinge. It is described as consisting of two species, the moist, and dry or spasmodic asthma.

The pathology of this disease is exceedingly obscure, and the post-mortem appearances contribute little towards giving us information. Some of the air-cells are found dilated much beyond their natural size, and sometimes air is found between the air-vesicles, and this may be named inter-vesicular emphysema; the bronchial tubes are sometimes dilated, and contain some viscid mucus; the disease is often complicated, with dilatation of one or more cavities of the heart, or disease of the valves. It is frequently associated with chronic bronchitis, and is by some referred to spasmodic contraction of the bronchial tubes; others impute it to peculiar condition of the nervous system.

Emphysema of the lungs during life is ascertained by the diminished respiratory murmur in the part affected, at the same time that there is clear sound upon percussion.

Treatment.—The remedies most efficacious are, bloodletting in small quantity, the foot-bath, laxatives, emetics and counter-irritants, and, in some cases, opium. In spasmodic asthma, stramonium taken internally or smoked, and the lobelia inflata, are often serviceable.

DISEASES OF THE CIRCULATORY SYSTEM.

Angina Pectoris.

Symptoms.—A sudden pain is felt across the chest, and particularly about the heart; there is a sensation of constriction, approaching to suffocation; difficulty of breathing. These symptoms come on in paroxysms, particularly after walking or eating. The pulse is weak and irregular; the countenance pale; there is cough, and slight expectoration. There is sometimes difficulty in lying down, and, occasionally, a peculiar sensation of numbness extending down the left arm.

The pathology of this disease is still obscure. The most frequent morbid state associated with it, is ossification of the coronary arteries: other diseased conditions of the heart sometimes attend it, such as ossification of the valves, and disease of the aorta: in some instances it might be referred to the morbid state of the liver or stomach, or to a neuralgic state of the thoracic nerves.

Treatment.—Moderate bloodletting sometimes relieves; sometimes carminatives and antispasmodics: the lightest food only should be allowed, and all active exercise and mental agitation guarded against; issues, blisters, and mineral tonics may be found serviceable.

Carditis, Pericarditis, Inflammation of the Heart and Pericardium.

Symptoms.—Pain in the region of the heart, of a dull oppressive character, soreness in the corresponding intercostal spaces and epigastrium, if pressure be made upwards; palpitation; the motion of the heart very perceptible, sometimes even at some distance; hurried respiration, anxious expression of countenance; the pulse is frequent and bounding, after a time irregular; there is a dry cough, and a feeling of sinking or faintness on exertion, and a very peculiarly anxious expression of the countenance. The tongue is white; sometimes there is moisture on the skin as in rheumatism.

The disease is almost limited to the pericardium, but in some cases affects the substance of the heart. According to some pathologists the lining membrane of the heart is always affected. It most frequently accompanies or follows acute rheumatism.

Physical Signs.—The pulsation of the heart is felt over a larger space than usual; percussion may give a more dull sound; the movements of the heart are hurried and jerking, sometimes intermitting and irregular, and there is often a bellows sound generally dependent upon endocarditis. In the second stage, when effusion has taken place, auscultation affords various sounds, like the rubbing of paper or parchment, or of the bellows or sawing kind; in some instances the sound resembles the creaking of new leather. In the stage of copious serous effusion the impulse of the heart is little perceived; there is more dulness on percussion, and the sounds of the heart are less audible. The pulse is then weak and irregular.

Morbid Appearances.—The pericardium is of a florid red colour, with great injection of its vessels; there is serum containing flocculi of lymph; the heart and bag of the pericardium are coated with lymph and sometimes there are adhesions; the heart itself is unusually vascular, and sometimes contains pus in its substance; frequently there are inflammatory appearances in the surrounding parts, and a deposit of lymph in the left ventricle.

Treatment.—Bleeding from the arm and locally, by leeches or cupping, after which mercury is the medicine most to be depended upon; it should be given so as to affect the mouth: a blister over the heart may be useful after leeching: purgatives and salines, with tartarised antimony may be given. The recumbent position is absolutely requisite. As the disease generally follows rheumatism, colchicum also is used.

DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

Inflammation of the Membranes of the Brain.

Symptoms.—This disease presents symptoms so varied, that no short description can convey an adequate idea of it. There is pyrexia; a quick jerking pulse; pain about the head, particularly at the vertex; tinnitus aurium; disturbed intellect: raving delirium; in the latter stages, convulsions; coma, and paralysis; the bowels are generally costive, and the skin hot and dry. The tongue is furred; and, when protruded, is often inclined to one side. There is sometimes squinting; and the pupil, which is at first contracted, becomes in the latter stages dilated.

Morbid Appearances.—Great vascularity of the dura mater, sometimes ulcerated, and with pus beneath it; the arachnoid is thickened and opaque, bathed with a quantity of serous fluid; the pia mater has its vessels exceedingly congested, or covered with pus; the vessels in the brain appear to contain more blood than usual, and there is a serous effusion in the ventricles.

Treatment.—Blood may always be taken away, either from the arm by the lancet, or from the temples by arteriotomy, or by leeches. Drastic purgatives should be given, and frequently repeated; the head should be shaved and cold applied to it nearly constantly. Blisters and sinapisms may be applied to the extremities, but not to the head or in its immediate vicinity. Calomel is a remedy of the greatest value in this disease.

Inflammation of the Substance of the Brain.

Symptoms.—The symptoms resemble somewhat those arising from inflammation of the membranes, but are much more obscure. There is pain and a sensation of weight in the head; vomiting; tinnitus aurium; strabismus; difficult articulation, and great restlessness; in a short time convulsions come on, and are often followed by paralysis or coma. The flexors of the paralysed limbs are often contracted. There is frequently constipation, and the patient generally lies upon his back.

Treatment.—The same treatment is required as for the inflammation of the membranes of the brain.

Delirium Tremens.

Symptoms.—Wild countenance, restlessness and sleeplessness; the tongue is white and tremulous; the pulse rather quick, but not full or strong; the skin often moist; mental delusion, with considerable fear and anxiety; the bowels are generally constipated, and most of the secretions are disordered. The pupil is often contracted, but in some instances is much dilated: the hands and feet are ordinarily cold and clammy. These symptoms may last three or four days, and will then be carried off by a sound sleep; but, in unfavorable cases, the powers sink gradually, and the patient dies in convulsions. It is generally occasioned by drinking stimulating liquors to excess.

Treatment.—At the commencement, leeches may sometimes be applied to the head, but general bleeding is inadmissible; a dose of calomel and some mild purgative may be given, and be followed by opiates in large doses. A combination of tartarised antimony, with opium, is reported, in several cases, to have been very successful. Sometimes it is necessary to give a portion of the habitual stimulus, such as gin, brandy, &c., or substitutes for it, such as ammonia and ether.

Hydropcehalus, Water in the Head.

The progress and symptoms of this disease are very variable; sometimes it simulates the phrenitis of adults, and carries off the patients in a few days, and then properly might be designated acute, or the water stroke: more frequently its progress is slower, and certain stages may be distinguished. It mostly attacks children from two to seven years of age.

Symptoms, of the first, or premonitory stage: quick pulse, white tongue, hot skin, and disturbed sleep; loss of appetite, thirst, occasionally vomiting; indisposition to exertion; wasting of the body and febrile exacerbations towards the evening, with other symptoms, such as are linked with infantile remittent fever.

In the second, or inflammatory stage, the skin is dry and hot; the face flushed; the eyes red; the hands carried often to the head; screaming suddenly, both when awake or during sleep; great restlessness; fear of falling; intolerance of light and sound; contracted pupil; bowels often relaxed, with green slimy fetid stools.

In the third stage, or that of effusion, the pulse is very irregular; the pupils dilated; there may be strabismus, coma, constant moaning, with occasional short screaming; grinding of the teeth; partial paralysis; one eye often reddened, with thick viscid secretion adhering to the lids, and falling of the upper eyelid; occasional convulsive fits.

In the fourth stage, or attempt at reaction, the pulse rises to 140 or 160, the skin hot and dry; total insensibility, involuntary discharge of the fæces; the lips are dry and cracked; the tongue dry; inability to swallow; startings of the limbs; and a convulsive fit carries the patient off.

Morbid Appearances.—Inflammation of the membranes; the convolutions of the brain flattened: the substance of the brain softened; the septum lucidum often broken down; collection of fluid in the ventricles, which does not coagulate by heat, like the serum of the blood; fluid is also found between the membranes, whence a division has been made into hydrocephalus externus and internus.

Treatment.—General and local bloodletting, cold applied to the head, drastic purgatives, calomel, blisters, digitalis, pediluvia, mustard cataplasms, &c.

Chronic Hydrocephalus is known by the immense size of the head; the bones become separated, and consequently the spaces named fontanelles are very perceptible: the rest of the body is usually in an atrophied state; the intellect often is not impaired, and the functions of the body are carried on without much difficulty, till more acute symptoms show themselves, and carry off the patient. This morbid state may exist for many years.

The *Morbid Appearances* in the head are flattening of the surface of the brain; general softness, and a large collection of fluid in the ventricles, which communicate freely together.

Treatment.—Attend to the general health; give occasional doses of hyd. c. cretâ and mild tonics; let the head be kept cool. It has been proposed to tap the head, and afterwards compress it; the practice is old, but a few years ago was advocated strongly by Dr. Conquest. Iodide of potassium in small doses has sometimes seemed to do great service.

Apoplexia, Apoplexy.

Symptoms.—Sudden loss of power, sense, and motion; coma, stertorous breathing; countenance usually pale or livid; pupil generally dilated; the teeth clenched; foaming at the mouth; pulse full, and generally slow. The premonitory symptoms are such as arise from determination of blood to the head.

It comes on sometimes more gradually, with faintness, pain in the head, and vomiting; and in a few hours subsides into coma. The first symptoms in other cases, are paralysis of one side and loss of speech; in a few hours merging into the apoplectic fit.

Morbid Appearances.—Effusion of blood into the substance of the brain, especially the corpora striata and thalami optici, into the ventricles, or between the membranes, varying considerably in quantity; effusion of serum in the ventricles, or upon the surface, with great turgescence of the vessels; sometimes apoplectic cysts or cells, from which blood has been absorbed, with some discoloration and softness of the surrounding substance; sometimes the arterial branches at the base of the brain are found in an ossified state. In some rare instances no morbid appearance can be discovered.

A division of apoplexies is sometimes made into sanguineous, serous, and nervous, without sufficient foundation, and without aiding us in the diagnosis and treatment. If a weakly, spare, aged person be seized with apoplexy, it is suspected to be serous or nervous, although in the majority of cases there is extravasation of blood. A difference may be made in the treatment: depleting measures must be more moderate; counter-irritation more relied upon; and if the powers collapse, diffusible stimulants may be requisite. An admirable account of these varieties will be found in a work by Dr. Cooke, on 'Nervous Diseases.'

Treatment.—Bloodletting, general and local; drastic purgatives, such as croton oil; cold applications to the head, and a blister to the nape of the neck; sinapisms to the feet; irritating injections; the head should be kept elevated; and a brisk action on the bowels should be kept up for some days.

Paralysis, Palsy.

Symptoms.—Loss of motion in some part of the body, preceded either by apoplexy, or by a diseased state, known by a tingling sensation, pain in the head, and loss of memory. Loss of motion in one side is named hemiplegia; and when it affects the lower extremities, paraplegia.

In *hemiplegia* there is generally paralysis of the muscles of the face, which is drawn up on the healthy side; the tongue, when protruded, inclines to one side, generally to the paralysed one; there is difficulty in articulation and swallowing; and the heat of the paralysed limb is less than in the healthy side; the pulse there is also more feeble.

Morbid Appearances.—We may have the same as are found in apoplexy; or there are tumours, cysts, or parts of the brain changed in colour and consistence, and collections of matter: in some cases no discoverable lesion. The morbid appearances are almost always found in the side of the brain opposite to the paralysed parts.

Paraplegia, or paralysis of the lower extremities, is dependent either upon disease of the brain or spinal marrow. Cerebral paraplegia is most frequent in advanced age, and generally comes on gradually. The urine and fæces escape insensibly; sloughs are likely to form on the nates; and the patient dies, gradually exhausted. Cases of recovery are exceedingly rare. Spinal paraplegia may come on from injuries or inflammation, and is not uncommon in scrofulous children, when the spine is affected with curvature. Many other varieties of paralysis, more localised, are described in larger works.

Treatment.—In most cases, the same measures, but more moderate, may be employed here as in apoplexy; and when plethora and increased action have been subdued, counter-irritation may be useful in the form of a blister to the back of the neck, or back part of the shaved scalp; stimulating embrocations, and friction over the paralysed part; mercury in moderation, and iodide of potassium, to promote absorption: electricity and the use of strychnia are the usual adjuncts employed.

Tetanus, Rigid Spasm.

Symptoms.—Rigid spasms of the voluntary muscles of some portion of the body. It generally commences in the muscles of the neck. The spasmodic contraction of the muscles of the jaw and throat is called *trismus;* that of the muscles of the back, in which the body is bent backwards, is called *opisthotonos;* when the body is bent forwards, *emprosthotonos;* and, when bent laterally, *pleurosthotonos.*

The disease is divided into traumatic and idiopathic. The disease comes on gradually, with stiffness in the neck and pain on motion, uneasiness in the throat, and deglutition difficult; afterwards the jaws become firmly fixed by the temporal and masseter muscles; the spasmodic action then extends to the muscles of the trunk, and is often accompanied with a severe pain shooting through the chest. There are sometimes slight remissions, after which the spasms return with increased violence, and the patient dies horrible convulsed.

Morbid Anatomy throws very little light upon the disease; but if there be one appearance more common than another, it is inflammation of the theca vertebralis in the neck, and increased vascularity about the medulla oblongata.

Treatment.—The treatment must vary according to the causes and probable effects on the system. If it arises from wounds, and there is evident inflammatory diathesis, bleed largely from the arm; use the cold bath, and cold affusion; give purgatives and mercury to salivation, and prussic acid. Idiopathic tetanus requires powerful antispasmodics, such as opium, musk, camphor, and ether, warm bath, Peruvian bark and wine, embrocations, and stimulant applications externally. Of all the remedies, opium and calomel in large doses hold out the best promise. The tobacco enema has great influence over the spasms, but does not appear to cure the disease. Chloroform also subdues the contractions for a time, but does not effect any cure.

Epilepsia, Epilepsy.

Symptoms.—This disease is characterised by fits, which are accompanied by the following symptoms: sudden loss of sense and voluntary power, pupil fixed and immovable; respiration hurried, with an apparent sense of suffocation; convulsive fits, with spasmodic contraction of various muscles of the body, especially those of the face. They gradually diminish, but leave the person still insensible, and apparently comatose. The fit is generally preceded by a cold sensation, like something creeping up the body, and is called *aura epileptica;* and often by pains in the head, and unusual distressing feelings. Other varieties of epileptic fits are described, such as *tetanoid,* with tonic spasms, or protracted rigidity of the muscles; another in which there is insensibility with relaxation of the muscles; and a third, which has received the name of *catalepsy,* in which the limbs remain rigidly fixed in any position which bystanders may put them in. The causes, or states of system connected with the disease, are various, such as dentition, worms, other irritants in the intestinal canal, excessive drinking of spirits, hysteria, excessive sexual intercourse, profuse evacuations by hæmorrhage or purging, and several organic changes. In many cases no cause can be detected, either during life or after death.

Morbid Appearances.—Those found in the head are congestion of the vessels, thickening of the membranes with ossific deposits in them; tumours and abscesses; the cerebellum is most frequently diseased of the parts of the head. I would again refer the reader to Dr. Cooke's excellent work on 'Nervous Diseases' for the history of this disease.

Treatment.—During the fit, prevent the patient from hurting himself; and if debilitated, give stimulants and antispasmodics. During the interval, apply the treatment requisite for the plethoric or debilitated condition of the system. Mineral tonics, such as preparations of zinc, iron, and copper are the best. It is in this disease that nitrate of silver has been so frequently administered, and is resorted to when the disease appears to be independent of organic affection, and the pathology of it is totally obscured, and other mineral tonics have failed to effect a cure.

Chorea, St. Vitus's Dance.

This disease most frequently attacks females, and those only who have not arrived at puberty, most commonly between the tenth and fourteenth year.

Symptoms.—Convulsive motions, affecting generally the extremities of one side only. The muscles of the face, and indeed all the voluntary muscles, are sometimes affected. These motions are observed most in an attempt being made to walk or to grasp anything. The pulse is generally quick, and there is an unhealthy appearance of the eyes and complexion; the intellect is sometimes impaired. It depends either upon worms, hardened fæces, sometimes constitutional debility, irritation in the spinal chord, and irregular action of the nervous system. It generally lasts two or three months, sometimes for years.

Treatment.—The disease has been cured by free purging, long continued, according to the plan of Dr. Hamilton; also by tonics, as sulphate or sesquioxide of iron, sulphate of zinc, Fowler's solution, &c.; by powerful shocks produced on the body and nervous system, as by the cold or shower bath; and by leeches and blisters applied to the spine.

Hysteria, Hysterics.

Symptoms.—The hysterical fit comes on with faintness, agitation, convulsive startings, hurried breathing, chiefly abdominal, and very forcible; the face pale, the eyes turned upwards, insensibility, throwing about of the arms, beating of the chest, clenching of the hands, and powerful muscular contraction. These are followed by sobbing, and sometimes by immoderate fits of laughter, and afterwards by the discharge of much limpid urine; when sensible, the patient complains of a sensation like a ball rising in the throat, named *globus hystericus*, and a severe pain referred to the head or side, which is called *clavus hystericus*. The symptoms are exceedingly variable in different cases.

Treatment.—Apply stimulants to the nose and temples; dash cold water over the face and neck; bloodletting is seldom indicated, and only when the patient is exceedingly robust and plethoric: give antispasmodics, purgatives, and tonics, after the attack.

DISEASES OF THE SKIN.

Erysipelas, St. Anthony's Fire.

Erysipelas is described under two names, as *erythematous* and *phlegmonous*, the former being seated in the skin, the latter attacking the cellular tissue and fascia, in addition to the superficial parts. Phlegmonous erysipelas is distinguished by greater swelling, the colour of the part is more livid, or of a more dull red, and it frequently leads to extensive suppuration and sloughing, requiring free incision to allow the escape of the pus and slough, and at the same time supporting the strength by nourishment, tonics, and stimulants.

Symptoms.—Erysipelas always commences with febrile symptoms, which accompany it till its termination. There is nausea and vomiting; pulse generally hard and full. About the second or third day, the eruption appears of a red colour; the inflamed part is much swollen, and has a sensation of tingling and great heat. When the head and face are attacked (which is of frequent occurrence), great pain is felt, and confusion of thought and delirium ensue. The face becomes very œdematous, and the eyelids are closed. The eruption terminates in a few days by desquamation, phlyctenæ or vesicles, and the symptoms gradually subside. Œdematous effusion is a frequent attendant and consequence of idiopathic erysipelas.

Causes.—Checked perspiration, abuse of liquors, but most frequently some irritating matters in the primæ viæ. It may be called also traumatic, from occurring so repeatedly in hospitals after wounds or operations.

Treatment.—The treatment at first must be purely antiphlogistic, modified according to the age and constitution of the patient. Emetics at the commencement are generally very useful, and should be followed by a dose of castor-oil, and subsequently saline purges. Wine, bark, and stimulants in general may be given to debilitated persons. During the last two or three years the tincture of the sesquichloride of iron has been given in half drachm doses every three or four hours with apparently great success. When the violence of the inflammation has abated, cold spirituous lotions may be applied to the part affected. Numerous external applications have been advocated, such as common flour sprinkled over the part, cotton, as in bnrns, mercurial ointment, a solution of nitrate of silver, &c.

DISEASES OF THE URINARY AND GENITAL ORGANS.

Nephritis, Inflammation of the Kidney.

Symptoms.—Pyrexia, nausea and vomiting; pain in the region of the kidney, which is felt along the course of the ureters; in the male, there is often a retraction of the testicle, or a sensation of pain in it; a numbness in the leg and thigh of the affected side; urine scanty and high coloured, sometimes tinged with blood. The disease is very apt to terminate in suppuration, which may be detected by pus passing away with the urine. Nephritis is often induced by a stone in the kidney; sometimes by cold, external violence, or powerful diuretic remedies.

Diagnostic Character.—Retraction of the testicle, and vomiting; pain not materially increased by the erect position.

Treatment.—General bloodletting, and local by leeches or cupping, cathartics, diaphoretics, and copious mucilaginous drinks; warm bath; mercurials in moderation may be used. Blisters and the powerful diuretics are improper, as they are apt to induce strangury and to increase the severity of the symptoms.

Albuminuria, Bright's Disease of the Kidney, also known as Fatty Degeneration of the Kidney.

The kidney is liable to undergo a change of structure to which the term *granular degeneration* of the kidney has been applied. The exciting causes are unknown, but it seems to be a consequence of previous acute inflammation, and may possibly date its origin from an attack of scarlatina. The state of the kidney at an early period is seldom ascertained, but from post-mortem examinations, it appears that at first the kidney is larger than natural, more congested with blood, and exhibits dark radiating striæ; this morbid congestion leads gradually to a deposit of new matter in the kidney, first in the cortical part, afterwards in the tubular portion, and on a section, presents an appearance of the presence of numerous pale granules. The colour and general appearance are very variable, as may be seen in the splendid work by Dr. Bright upon this subject. The consequences to the body from this disease are a general breaking down of the system, muscular and mental debility, pallor of the surface, an appearance of anæmia dependent upon a vitiated condition of blood, which is of less specific gravity than natural, and contains a much less proportion of the red globules. The urine is altered in quality, but varies in quantity, being sometimes scanty, at other times in excess. Its average specific gravity is 1·010, and it always contains albumen, more abundantly in the early period of the disease; but the urea and salts are in a diminished proportion, consequent upon disease of the kidney; ascites manifests itself soon after, followed by an anasarcous state, and it is the dropsy frequently which first calls the attention of the physician to the kidney. In the latter stages there is a tendency to inflammation of serous cavities, supposed to depend upon an abnormal quantity of urea in the blood, and which finally leads to coma under which the patient sinks. The prognosis in these cases is extremely unfavorable, for hitherto no means have been discovered for removing the diseased structure, and of restoring the kidney to its healthy functions.

Treatment.—The means of cure, notwithstanding the numerous pathological investigations, are very unsatisfactory. It is agreed upon that mercury is generally mischievous, for in this case it sets up salivation very rapidly. The surface should be kept warm: perspiration may be promoted by repeated doses of Dover's Powder; preparations of iron may be given, and also of iodine, combined with hemlock. The bowels should be kept open by castor-oil, or other vegetable purgatives, and squill, in small doses, may occasionally be given, and during the disease, rubefacients and irritants may be applied over the region of the kidneys.

Cystitis, Inflammation of the Bladder.

Symptoms.—Pyrexia: pain and tenderness about the perineum, with heat, and sometimes swelling in the hypogastrium; frequent attempts to make water, which is evacuated, high coloured, ropy, in small quantity, and with great pain; there is often tenesmus, sickness, and occasionally delirium. It may come on from over distension, cold, extension of inflammation in gonorrhœa, presence of calculi, and use of violent diuretic remedies.

Treatment.—Similar to that for Nephritis.

Diabetes, Excessive Secretion of Urine.

Symptoms.—The most characteristic feature in this disease is the excessive flow of urine of a particular quality, which sometimes amounts to as much as twenty pints in twenty-four hours. By Drs. Prout, Copland, and others, the term is restricted to that form of diuresis which is attended by a secretion of saccharine matter, known as diabetes mellitus, and not including diabetes insipidus. The urine is pale straw-coloured; of a faintish odour, taste saccharine, specific gravity from 1·025 to 1·050. Urea and uric acid, as well as the usual saline ingredients are diminished in quantity. There is generally languor, lassitude, and debility, dry and occasionally hot skin, some fever, thirst, strong appetite, constipated bowels, pains in the back, along the course of the ureters, the prostate and urinary passages generally. But the constitutional symptoms have been so various in different people, that they cannot be laid down with any precision.

The *Morbid Appearances* in the kidney have chiefly been enlargement with redness, or softened, pale, and flaccid, with a similar condition of the renal vessels.

Treatment.—The treatment must vary, according to the individual and period of the disease; on general principles, the bowels should be rather freely acted upon, by colocynth, scammony, and such purgatives, but not by salines. The surface should be kept warm to excite diaphoresis, and even irritated by rubefacients, or vesicants. The food should be chiefly animal, with a small proportion of drink; opium and astringents have been largely used, and especially the first, with good effect. The muriated tincture of iron seems often to be beneficial, but unfortunately the disease may be palliated for a time, to return soon after, and carry off the patient prematurely.

The other variety of diabetes named *insipidus*, is characterised by symptoms resembling the former, but it is a much more curable disease. It may attack persons of various ages, occurring occasionally in children. The urine is exceedingly watery, free from sugar, and possessing less of urea, and of the usual salts of the urine. In this form of disease, mineral tonics and opium are very beneficial, and creasote, in some cases, has appeared to effect a cure.

Ischuria Renalis, Suppression of Urine.

By ischuria is understood a suppression of urine, that is the kidney secretes no fluid, and consequently none finds its way into the bladder; the adjunct *renalis* is scarcely necessary to point out its situation. The disease is most common in adults, corpulent, and rather advanced in life, but it so seldom occurs, that many men in extensive practice have not met with a case.

The *symptoms* attendant upon it are not well marked at the commencement. Sometimes we have rigors, with nausea and feelings of prostration; no urine is voided, and perhaps not for the preceding twenty-four hours; the pulse is rather slow, and there is a feeling of drowsiness; in the course of twelve hours, or later from this time, coma shows itself, and frequently carries off the patient in four and twenty hours. An urinous smell has been observed to emanate from the skin for some hours before death, and, in fatal cases, a smell of urine has been detected in the ventricles of the brain.

Treatment.—The remedies which have been employed are venesection and cupping over the loins, the warm bath, sudorifics, purgatives, and copious enemata. Some advocate the use of stimulating diuretics, such as cantharides, taken both internally, and applied in the form of a blister over the loins.

Hysteritis, Inflammation of the Uterus.

Symptoms.—Pyrexia; pain and tension in the hypogastric region, the pain being increased upon pressure; vomiting: when the inflammation is slight, there is a frequent desire to pass the urine and fæces; if the inflammation runs high, there is constipation and dysuria. Pure hysteritis is of very rare occurrence.

Treatment.—The usual antiphlogistic measures.

Hæmaturia, Voiding of Blood through the Urethra.

Symptoms.—Pain, with a sensation of weight in the loins, and in the region of the kidneys. The urine is evacuated, mixed with blood, which may come from the kidneys, bladder, or urethra. It is generally a symptom of other diseases, sometimes accompanying hæmatemesis, and other diseases of a hæmorrhagic nature, and is not unfrequently a consequence of blows or injuries to the lumbar region.

Treatment.—The treatment must depend on the precise seat of the affection; therefore, the remedies must be adopted according to the part affected.

Chlorosis, Obstruction of the Menses (Green sickness).

Symptoms.—Dyspepsia; pale countenance; listnessness, and disinclination for exercise or fatigue; palpitations, dyspnœa, and occasionally syncope. Depraved appetite, and dislike to usual food; the legs become sometimes œdematous. The colour is referred by some pathologists to a deficiency of red particles in the blood. The pulse is commonly weak, and there is general languor of the system; abnormal sounds, such as bruit de soufflet, and a cooing noise, are sometimes heard about the heart and trunks of the large vessels. If not corrected, anasarca is likely to supervene, and afterwards phthisis sometimes manifests itself.

Treatment.—A light nutritious diet; gentle exercise, particularly on horseback: warm tonic purgatives, especially aloes; the preparations of iron are singularly efficacious, when combined with mild aperients: tonics may be given, such as cascarilla, chamomile, gentian, &c.; and, when there is great languor, stimulants are admissible, such as camphor and ammonia; to these we may add the cold and warm bath, chalybeate waters, and electricity.

Menorrhagia, Immoderate Flow of the Menses.

Symptoms.—Great discharge of menstrual fluid or blood, accompanied by pain in the back and loins. There is generally pyrexia; it occurs both to plethoric and debilitated habits, hence named *sthenic* and *asthenic*, and may depend upon inflammation of the lining mucous membrane of the uterus, polypi, and other organic diseases of this viscus.

Treatment.—The remedies to be employed are bleeding and cooling purgatives for the plethoric; for the debilitated, cooling astringents and tonics, especially the muriated tincture of iron; the horizontal position is necessary in all cases, and cold may be applied to the pubes. Ergot of rye will sometimes check the discharge when other remedies fail.

DISEASES PRINCIPALLY ATTACKING FIBROUS AND SYNOVIAL MEMBRANES.

Podagra, Gout.

Symptoms.—Pyrexia; disordered state of the digestive organs; pain, swelling, and redness of the smaller joints, most frequently of the great toe. The violence of the symptoms recurs in paroxysms, being most severe towards night. In some cases, the pain of the joints is less severe, and there is considerable debility, constituting *podagra atonica*. In *podagra retrograda*, the swelling suddenly disappears in the joints, and a metastasis takes place to the stomach, or some other viscus. After a part has been attacked with the gout, it is sometimes found to be enlarged, and uneven on its surface, occasioned by a deposit in or underneath the skin, of a calcareous appearance, named *chalk-stones* or *gouty concretions;* the composition of which is, uric acid and soda.

Gout is one of those diseases called hereditary, seldom coming on before the age of forty, and more generally attacking males. It is commonly preceded by, or dependent upon, some disorder in the functions of the stomach, small intestines, skin, or liver; and the more immediately exciting causes are excess in diet, want of exercise, suppressed evacuations, and depressing emotions of the mind. It has been already shown that uric acid exists in the blood in excess in these cases; and it is not improbable that this acid may be the immediate cause of this peculiar inflammation. The parts attacked by it in common cases, are the skin, the cellular, fibrous, and serous membranes.

Diagnosis between gout and rheumatism. Gout scarcely ever occurs before puberty; is generally preceded and accompanied by considerable disorder of the alimentary canal; is generally seated in the great toe on the first attack; and the inflamed part is more tumid, more painful, and of a brighter red colour.

Rheumatism is brought on by exposure to cold; comes on more suddenly; has not the remissions, like gout, and attacks fewer structures at the same time.

Treatment. — Mildly antiphlogistic. Bloodletting is seldom required; cooling laxatives may be given, and the affected part may be enclosed in flannel, so as to excite diaphoresis. Colchicum is found almost a specific in removing the acuteness of the pain. Iodide of Potassium is also very useful. Rest in recumbent posture is necessary.

Chronic gout must be treated by attention to diet, abstinence from heating liquors, gentle exercise, mild aperients and sudorifics. If internal inflammation comes on, venesection may be necessary, and leeches may nearly always be applied over the part attacked.

Rheumatismus, Rheumatism.

Symptoms of the Acute Form.—Pyrexia, swelling, redness and tension of the larger joints; urine high coloured, occasionally profuse perspiration; the pulse is frequent and full, but generally compressible. There is a tendency in the inflammation to change its seat from one joint to another. Sometimes the pericardium and heart become attacked. Its most frequent cause is exposure to wet and cold.

In chronic rheumatism, the part affected is not always red, but is rigid and painful on pressure. When chronic rheumatism attacks parts about the hip in the course of the sciatic nerve, it is called *sciatica;* when it attacks parts about the lumbar fascia and muscles, it is called *lumbago.*

The seat of the rheumatism is in the fasciæ, cellular membrane, fibrous tissues generally, muscles, synovial membranes, and sheaths of the nerves.

Treatment.—Common antiphlogistic; general and local bloodletting; purgatives; colchicum: diaphoretics; narcotics and fomentations are of great benefit: amongst the plans of cure pursued, some give cinchona, some rely upon calomel and opium, and others give blue pill, in repeated doses, till it slightly affects the mouth. Some rely upon lemon-juice given in doses of ʒss. to ℥iss. three or four times a day; others give nitrate of potash largely, whilst others rely mainly upon the bicarbonate of potash. Chronic rheumatism is to be combated by colchicum, guaiacum, Dover's powder, warm bath, small repeated doses of mercury, iodide of potassium, blisters, exercise, and friction.

HYDROPES.

Dropsies.

Dropsical effusions may result from several different morbid states. They may depend upon membranous inflammation; or upon mechanical obstruction, as by tumours, or enlarged and hardened viscera pressing upon the large venous trunk, thus preventing the free flow of blood, so that the vessels are compelled to relieve themselves by discharging a portion of their limpid contents. They may also depend upon general debility of the system, when the exhalants become patulous, from the weakened nervous energy which usually presides over secretion. Some explain the effusion by supposing an increased secretion, and decreased power of absorption. The fault, however, does not appear to be so much in the absorbents as in the exhalants, for if exhalation be stopped, in nearly every case, the absorbents will rapidly remove the effused fluid. The diseased viscera which most generally bring on dropsy, are the heart, the liver, and the kidneys.

Anasarca, General Dropsy.

Symptoms.—A soft inelastic swelling of the whole body, or greater part of it. If pressure be made on a part, the impression of the finger remains for some time, producing the appearance called pitting. This effusion, when partial, is called *œdema*. It can scarcely be considered idiopathic or primary. It occurs often after scarlatina; but in such cases we generally find effusion in the chest or abdominal cavity, sometimes in the pericardium. Free purging is one of the most effectual modes of removing the fluid in such circumstances. General dropsy has sometimes shown itself rather suddenly in some plethoric persons after exposure to severe cold. The cutaneous exhalation here appears to be entirely checked, and a quantity of fluid is thrown back upon the system. In this case bloodletting will be requisite to diminish the quantity of circulating fluid, and will be aided by free purging and diaphoretics.

Ascites, Dropsy of the Belly.

Symptoms.—A dense somewhat elastic swelling, or enlargement of the abdomen. A sense of fluctuation is given to the hand on percussion; there is hurried respiration, scanty urine, constipated bowels, œdema of the extremities.

This effusion may depend upon inflammation of the peritoneum, which will be known by the constitutional symptoms, and the tenderness upon pressure over many parts of the abdomen. It is often connected with diseased liver, which causes an obstruction to the passage of the blood through the vena portæ, and in addition may exert mechanical pressure on the inferior vena cava; such cases are generally known by the history of the patient's habits, and by symptoms of hepatic disease, such as tenderness on pressure over the liver, a sallow, jaundiced countenance. The spleen by enlargement may bring on this dropsy, also any impediment to the passage of the blood through the right side of the heart. According to Dr. Bright, a diseased state of the kidney is one of the most frequent causes; it is distinguished by the quality of the urine, which is highly albuminous, and may be found to be so by the application of heat and nitric acid to the excreted liquid. The morbid appearances will correspond with the diseases above mentioned. The disease of the kidney is a granular state of the cortical part, sometimes with enlargement and unevenness of surface. The interior is of a more homogeneous structure, not presenting the defined difference between the two parts. Sometimes it is yellow and mottled, and in others assumes almost a cartilaginous hardness.

In females, pregnancy and ovarian dropsy may be mistaken for ascites, and in some cases the diagnosis is not very easy, especially when the patient is interested in misleading the medical man.

In ovarian dropsy, there is at first a defined tumour on one side, which enlarges gradually till it occupies nearly the whole abdominal cavity. In this state, the feeling of fluctuation on percussion is less distinct; and it is said that there is a less degree of transparency. The general health may be very little impaired, which can scarcely be looked for in a case of ascites.

Treatment.—If there be any organic disease it must be first attended to; for if the effusion be stopped, the absorbents will soon carry off what has been thrown out. The hydragogue cathartics are very useful sometimes, such as elaterium, colocynth, scammony, and gamboge; and to get rid of the fluid as quickly as possible, tapping is advantageously practised. Diuretics and diaphoretics should also be employed.

Hydrothorax, Water in the Chest.

Symptoms.—Difficulty of breathing, particularly in the horizontal posture; pale and livid face; purple colour of the lips; scanty urine; starting from sleep; palpitation; and œdema of the legs and feet. When the effused fluid is abundant, it generally exists on one side only.

The *Physical Signs* are enlargement of the side affected, with projection at the intercostal spaces; dulness of sound on percussion, which may vary with the position of the patient; loss of respiratory murmur; if the voice be audible in the part, it will be bronchophonic; if there be a little fluid in the chest, we may perceive ægophony.

Morbid Appearances.—Thickening of the pleura, with layers of lymph; a large quantity of yellowish serum; sometimes with flocculi of lymph; the heart is often found dilated and hypertrophied; or we find in it disease of the mitral valve, or sigmoid valves; sometimes disease of the arch of the aorta; but in some rare instances no organic disease in the neighbourhood is discoverable.

Treatment.—As this disease generally results from inflammation of the lungs, or pleura, or obstructions in the heart, or aorta, moderate and careful bloodletting is generally indicated, both from the arm, and locally by leeches. Blisters and other counter-irritants are applied, and sometimes tapping is resorted to. The most valuable medicines in these cases are, mercurials, with digitalis, squill, and nitrate of potash, and elaterium.

CLASSIFICATION OF SKIN DISEASES,

ACCORDING TO DR. WILLAN.

Ord. 1.

PAPULÆ.

Strophulus.
Lichen.
Prurigo.

Ord. 2.

SQUAMÆ.

Lepra.
Psoriasis.
Pityriasis.
Icthyosis.

Ord. 3.

EXANTHEMATA.

Rubeola.
Scarlatina.
Urticaria.
Roseola.
Purpura.
Erythema.
Erysipelas.

Ord. 4.

BULLÆ.

Pemphigus.
Pompholyx.

Ord. 5.

PUSTULÆ.

Impetigo.
Porrigo.

Ord. 5, *continued.*

Ecthyma.
Variola.
Scabies.

Ord. 6.

VESICULÆ.

Varicella.
Vaccinia.
Herpes.
Rupia.
Miliaria.
Eczema.
Aphtha.

Ord. 7.

TUBERCULA.

Phyma.
Verruca.
Molluscum.
Vitiligo.
Acne.
Sycosis.
Lupus.
Elephantiasis.
Frambœsia.

Ord. 8.

MACULÆ.

Ephelis.
Nævus.

THE URINE.

The following observations upon the Urine are placed here, as more connected with practical medicine than any other department.

The urine is very prone to deviate from the healthy state, and is known to be an index of some important changes taking place in the body, which might not be known without recourse to an examination of this excretion. It is, therefore, necessary that the student should know not only how to detect the proximate principles of healthy urine, but likewise be familiar with the appearances and tests of urine in a morbid state. The author recommends their attention particularly to the works of Dr. Golding Bird, and Mr. J. E. Bowman on 'Animal Chemistry.'

The chief constituents of healthy urine may be detected in the following manner:

Mucus of the passages gives to the urine a cloudy appearance, on standing, especially when very cold, and may easily be collected by filtering through paper.

Uric Acid may be easily obtained by warming some urine, and adding to it a few drops of hydrochloric acid; by allowing this to stand a few hours, crystals of uric acid will collect, in the form of a pellicle, on the surface, and, by shaking, will sink to the bottom of the tube, and may be collected by filtering. They generally assume a rhomboidal or diamond shape.

Urea may be collected as described under the chemical notes; or we may evaporate the urine to one third its bulk, and add to it, its volume of nitric acid, when we have formed nitrate of urea, in the form of shining, micaceous, crystalline plates.

The *colouring matter* exhibits a beautiful pink, almost claret red colour, by boiling some urine and adding to it about one third its bulk of hydrochloric acid.

Sulphuric Acid is best demonstrated by treating the urine first with nitric acid, and afterwards adding nitrate of baryta when an insoluble sulphate of baryta will be precipitated.

Chlorine of the chlorides is easily detected by nitrate of silver, which will throw down chloride of silver, insoluble in nitric acid, but soluble in excess of ammonia.

Phosphoric Acid is shown by adding liquor ammoniæ to a drop or two of urine upon a slip of glass, and then submitting it to the microscope, when beautiful stellated crystals are seen of phosphate of ammonia and magnesia, thus showing the presence both of phosphoric acid and magnesia.

Lime may be exhibited by adding a little oxalate of ammonia, when crystals of oxalate of lime, of an octahedral form, may be seen.

Chloride of sodium may be easily exhibited, by evaporating the urine, and, when nearly dry, examining it with the microscope, when we see it presenting the forms of a cube chiefly, but also octahedra, and crosslets.

Bile may be demonstrated by placing some urine on a white plate, and dropping upon it a little nitric acid, when we have a change of colours produced, from bluish-green passing on to red.

The following is a description of the morbid constituents of urine, as well as some urinary deposits, with their microscopic characters and tests:

Albumen.—Urine containing this substance is generally more or less opaque; its specific gravity is lower than usual, in Bright's disease averaging 1·010, and it froths excessively when shaken up. The best tests are — heat and nitric acid; it is generally advisable to add them both, inasmuch as the nitric acid occasionally precipitates the lithates, which heat again dissolves, and albumen is not coagulated, if in small quantity and the urine is alkaline.

Albuminous urine, when examined by the microscope, is generally found to contain numerous epithelial scales, as well as a few blood-discs, and occasionally a slight sediment.

Bile.—This is very rarely found in the urine. It gives to linen a permanent, brownish-yellow stain. It gives a green colour with hydrochloric, sulphuric, and nitric acids, in the latter case afterwards passing to a red tinge.

Blood.—This is known by the colour it gives the urine, as well as by the blood-corpuscles visible by the aid of the microscope. When the blood is in any considerable quantity, a bright red colour is given by adding common salt.

Cystic Oxide.—This substance is so rarely found in the urine, that there are no important tests given for it. The urine is of a yellowish or greenish colour, somewhat opaque, and generally more or less fetid.

Hippuric Acid is hardly ever found in man, except when he is taking benzoic acid medicinally; it is, however, sufficiently abundant in the urine of cows and horses. It generally occurs in four-sided prisms, and rarely exists alone in the urine.

Kiestein.—This is a peculiar substance, found only in the urine of pregnant females. It separates from the urine as a thin transparent pellicle, after the urine has been exposed to the air and at rest for two or three days. It reflects the rays of light, and separates them into the prismatic colours. In a short time (about a week) the pellicle breaks up, and diffuses itself through the fluid, finally settling to the bottom. It has a cheesy — some call it an aromatic — odour, and preserves the urine, to a considerable extent, from decomposition. It is distinguished from albumen by its not being coagulated by heat or nitric acid.

Lithic Acid, alias *Uric Acid.*—Though more soluble by heat, it is insoluble in cold urine. It occurs as a reddish crystalline powder, which settles from the urine when it cools. Its crystals are rhombic in form, and soluble in alkalies.

Lithates.—The deposit from these is of all shades, from dirty white or yellow, to bright pink. The lithates of soda and ammonia are amorphous, whilst those of lime form needle-shaped crystals, and those of magnesia prismatic. Like uric acid, the lithates give an acid reaction to the urine. The lithates are rendered soluble by heat and alkalies.

Mucus.—Urine containing this substance in excess is more or less opaque and fetid, generally alkaline, and very prone to decomposition. Mucus is not affected by heat or nitric acid, though it is thrown down by acetic acid. In urine containing excess of mucus are found generally phosphate of lime, or the triple phosphates.

Phosphatic Deposits.—These are of three varieties: phosphate of lime, triple phosphate, and fusible precipitates. In all three the urine is of feebly acid or alkaline reaction. All the precipitates are soluble in acids, with effervescence, and are unaffected by alkalies or heat. The phosphate of lime is amorphous, whilst the triple phosphates form prisms. The urine, in the former case, is opaque, and of high density; in the latter, clear, and of about the usual specific gravity. In the case of the usual fusible precipitates, the urine is of low specific gravity, and putrescent. The deposit is amorphous.

Oxalic Acid Deposits.—Oxalate of lime does not alter the usual characters of the urine, as there is rarely any sediment. The urine is somewhat opaque, and darker than usual, and minute octahedral crystals are diffused through the whole, and they also assume the form of dumb-bells. By heat the oxalate of lime is resolved into carbonate, and this eventually into caustic lime. This being moistened and placed on turmeric paper, will give it a brown stain.

Pus.—This forms a creamy greenish light deposit, on the urine standing for a short time, and forms a peculiarly ropish tenacious substance on the addition of caustic potash. The supernatant urine is generally clear, and slightly acid in reaction. It is coagulated by heat or nitric acid, on account of the albumen it contains. Examined by the microscope, purulent urine shows peculiarly formed pus-globules, mixed with which are not unfrequently seen transparent oil-globules.

Purulent urine has no peculiar tendency to pass into decomposition.

Spermatozoa.—These are not very unfrequently found in urine, and are known by their peculiar form. The urine containing them is rarely different from the normal.

Sugar.—This is only found in cases of diabetes. Diabetic sugar is identical in composition with grape-sugar. The colour of saccharine urine is generally greenish, and its specific gravity high, varying from 1·025 to 1·055. The taste and odour are sweet. With yeast and a slight increase of temperature, alcohol is formed, and may be known by its properties, and carbonic acid is evolved. On the addition of sulphate of copper and solution of potash, a brown precipitate of suboxide of copper is thrown down. This test is called Trommer's, from its discoverer, and is the most satisfactory. On adding chromic acid (the solution being exposed to the rays of the sun), a brown precipitate is thrown down. Diabetic urine becomes brown when boiled with caustic potash.

Xanthic Oxide is so rarely met with as scarcely to require notice. Urine containing it has the appearance and reaction of lithic acid urine. With nitric acid it gives a yellow colour, that changes to red on the addition of caustic potash.

OBSERVATIONS ON MIDWIFERY.

The parts immediately engaged in the process of utero-gestation and parturition, are the female pelvis and genital organs, which form necessarily the first subject to which the attention of the accoucheur is directed.

The *pelvis* is a kind of osseous canal, situated at the base of the vertebral column. The bones which form it are, the *sacrum*, *coccyx*, and two *ossa innominata*. Each *os innominatum* is divided (in the fœtus, and for some time afterwards), into os pubis, ilium, and ischium.

These bones are connected together by strong ligaments, particularly at the *symphysis pubis* and at the sacro-iliac *synchondrosis*. The divisions of the true pelvis are into the *cavity*, the *brim* or *upper aperture*, and the *outlet* or *lower aperture*.

The *axis* of the *brim* is in a line drawn from the umbilicus to the extremity of the sacrum; that of the *outlet*, is in a line drawn from the promontory of the sacrum through the centre of the os externum.

The *diameter of the brim* of an average pelvis in the dry bones, taken from the symphysis pubis to the promontory of the sacrum, measures a little more than four inches; the transverse diameter measures five inches and a quarter; and the oblique diameter, from the depression corresponding with the acetabulum, on one side, to the sacro-iliac synchondrosis on the other, measures five inches. In the living state the oblique is rather longer than the transverse diameter.

The *diameters of the outlet* each measure four inches; but the antero-posterior may acquire an additional inch or more, by the yielding of the coccyx, so that the long diameter of the brim and outlet are reversed. The distance from the symphysis pubis to the hollow of the sacrum is about five inches.

For description of the uterus and its appendages, vide anatomy of those parts.

Dimensions of the Fœtal Head.—The length from the chin to the occiput is about five inches; from the occiput to the forehead, about four inches and a half; from the prominence of one parietal bone to that of the other, three inches and a half; and from the vertex to the base of the cranium, three inches.

The head of the fœtus being larger than any other part of the body, ensures to the rest an easy passage.

The bones of the head being imperfectly formed, have spaces between them, called *fontanels*, which allow the bones to overlap each other, when compressed.

The *anterior fontanel*, of a quadrangular shape, is situated between the junction of the frontal and parietal bones; the *posterior* one, of a triangular form, is found between the central junction of the occipital and parietal bones.

The *period of utero-gestation* is generally limited to between the fifteenth and forty-fifth years of age, or as long as menstruation continues. This function commences much earlier, and terminates much later in some constitutions and countries than in others. Its average duration is about thirty years.

When conception has taken place, the ovum is conveyed to the uterus by the Fallopian tubes, covered by the *chorion* and *amnion*. In the uterus the ovum receives an additional covering from the *membrana decidua*, which is proper to and from the interior of the uterus. From its mode of reflexion when the ovum enters the uterus, it is described as consisting of two parts, the *decidua vera* and *decidua reflexa*.

The *amnion* contains the fluid called liquor amnii, which has several uses. The liquor amnii preserves the fœtus from pressure, assists in forming the wedge to the os uteri during labour, and lubricates the passages.

The *placenta* is a spongy mass, composed of cellular tissue and the ramifications of blood-vessels. It is by some described as divisible into two portions, called fœtal and maternal, through which changes are effected in the fœtal blood. The placenta is generally attached to the fundus of the uterus.

In cases of twins, there are generally two placentæ, or they may be attached to each other at their edges, with the vessels anastomosing between them.

The *funis umbilicalis* forms the communication between the placenta and fœtus. It is composed of the umbilical vein and two umbilical arteries, connected together by cellular tissue. The average length of the funis is about twenty inches.

An average fœtus, at the end of nine months, weighs from six to eight pounds, and its length is about eighteen inches.

Symptoms of Conception and Pregnancy.—At first a sensation of chilliness, succeeded by febrile excitement; loss of appetite, with nausea and vomiting, particularly occurring on rising in the morning; amenorrhœa; plethora. After some time, the breasts swell, and become painful, and the areola is darkened and enlarged. Quickening occurs a little before the fourth month, and, in consequence of relieving the iliac vessels from pressure, is often attended by syncope. The motion of the fœtus soon becomes very perceptible; and there is gradual increase in the size of the abdomen.

The uterus for some time remains in the pelvis, until by increasing in size, it becomes too large for that cavity; it then rises into the abdomen, and that change of situation is called *quickening.*

Labour is that natural function of the body by which, at the expiration of forty weeks, or about two hundred and seventy-five days, the uterus contracts upon, and forcibly expels its contents, returning, in a short time, nearly to the same state as before impregnation.

The *diseases* or *disorders* occasioned by the pregnant state are *nausea* and *vomiting; cardialgia; pain in the head; hæmorrhoids; costiveness; irritability of the bladder,* with incontinence of urine; *œdema of the labia;* and a *varicose state* of the veins of the lower extremities.

The earliest period at which a child can live out of the uterus is the end of the sixth month. Labour occurring before the full period, but after the child can exist out of the uterus, is called premature labour; and, if it take place before the sixth month, it is considered as abortion, by Dr. Ramsbotham, and many others. Some authors call it *abortion,* if the ovum is expelled before the sixteenth week;

miscarriage after that time up to the seventh month; and *premature labour*, if between the seventh month and the full period.

The causes or means by which labour is accomplished are the contractions of the uterus, assisted by the abdominal muscles and diaphragm.

The *precursory symptoms* of labour are, generally, a partial subsidence of the abdominal tumour; a glairy mucous discharge, denominated shew; and a frequent desire to evacuate the bladder and rectum.

The *duration of labour* is subject to great variation, lasting from a few hours to several days. First labours are generally the most tedious and painful, in consequence of the slow distension of the parts unaccustomed to it.

The *first stage* of labour is accompanied by arterial excitement, particularly during the pains, restlessness and cries, nausea and vomiting; in addition to which, are the following symptoms, which afford the diagnostic character:

Pains accompanying each contraction, resembling cramp of the stomach or intestines. They commence generally at the fundus of the uterus, and pass on towards the pelvis, lasting two or three minutes, and recurring after intervals of about ten minutes, sometimes much oftener; they increase in strength and rapidity as the labour advances. The uterus, at the same time, may be felt hard and contracted, by the hand placed upon the abdomen. The os uteri becomes gradually dilated, and the membranes may be felt very tense during the contractions. Then follow a discharge of mucus tinged with blood, and increased dilatation of the os uteri, with a protrusion of the membranes, of an ovoid shape from the os uteri serving as a wedge to assist in the dilatation.

In the *second stage* of labour, after some time, the membranes burst with the expulsive efforts of the uterus, the liquor amnii escapes, and the uterus contracts with greater force upon the fœtus. The os uteri gradually dilates still more, and the child's head becomes engage, in the pelvis. After some time, the external parts relax and dilate, so as to allow the expulsion of the fœtus through the os externum.

The *third stage* is occupied by the expulsion of the placenta, which generally takes place in about half an hour. From the vagina it may be removed without any difficulty.

The position of the different parts of the fœtus in the uterus is generally the same, and such as to occupy the least possible space. The head inclines, and rests upon the thorax; the trunk is bent forwards: the arms lie down by the sides, with the forearms often crossed upon the sternum; the thighs are raised toward the abdomen, with the legs bent upon the thighs, and sometimes crossed, so that the heel is opposed to the buttock of the opposite side, and the feet are towards the front of the legs.

The parts of the fœtus which may present are numerous; but, for practical purposes, may be divided into four classes, which include *presentations* of the *vertex*, *face*, *pelvis* or *lower extremities*, *body*, or either *shoulder*.

Vertex presentations are the most favorable, and such as occur in natural labour.

Labours are classified in different ways by different authors; the most simple division is into *natural* and *preternatural*.

In the first are included labours in which the vertex or breech presents; the pelvis is of adequate dimensions, manual interference is not requisite, and the process is completed in twenty-four hours. In the second division we include protracted labours; labours with presentation of some part of the trunk, with twins, hæmorrhage, or convulsions.

Natural Labour.—Mechanical process: first, the head passes through the brim, with the occiput directed towards the acetabulum, more commonly the left; then a turn, equal to the eighth part of a circle, is produced by the inclined plane of the pelvis; the occipital protuberance is carried behind the symphysis of the pubis, and the face towards the concavity of the sacrum. The head then arrives at the outlet, and passes through it; the occiput emerges first, and then the face, sweeping along the concavity of the sacrum. After the passage of the head, the rest of the body escapes ordinarily, with considerable ease.

If the occiput rests upon either sacro-iliac synchondrosis, the face arrives behind the symphysis pubis, and the occiput rests against the concavity of the sacrum. The occiput emerges first, and the face afterwards.

In natural labour, little interference is required on the part of the accoucheur. He may assist the uterine contractions by gentle pressure upon the abdomen during the pains; and, when the perinæum is put upon the stretch, the left hand may be applied in such a manner as to give it some support.

When the fœtus is expelled, a ligature composed of thin tape, or of seven or eight pieces of thread, is to be tied tight round the umbilical cord, at the distance of two inches from the umbilicus; a second is to be applied in a similar manner, at two inches from the first, and then the cord is to be divided between them. The cord attached to the fœtus should then be examined, to ascertain whether any blood escapes ; if so, a tighter ligature should be applied.

Attention should then be paid to the placenta, which in common cases comes away very readily.

After it is expelled, place one hand upon the abdomen to ascertain whether the uterus be properly contracted to guard against the occurrence of hæmorrhage.

If the placenta be not expelled after waiting an hour, assistance will be required to extract it, which will depend upon the causes of retention.

The placenta may be retained in the uterus from loss or want of power of contraction ; by irregular contraction, by means of which it is forcibly retained ; and by adhesion to the lining coat of the uterus.

The management, in the first case, consists in using pressure over the abdomen by a bandage, compression of the uterus externally by the hand, and dashing cold water upon the abdomen. If these means are not adequate, the hand is to be introduced into the uterus, and gently moved about in it, until contraction comes on, and the placenta is expelled.

When the placenta is retained by spasmodic contraction, the usual treatment is to give a dose of forty or fifty minims of Tr. opii; after a short time the contraction relaxes, and the hand may be gently passed up to assist the relaxation.

The adhesion of the placenta to the uterus depends on previous inflammatory action, with the deposit of a coagulable lymph.

When it is found to exist by the retention of the placenta, retraction of the umbilical cord, and hæmorrhage, the hand must be introduced into the uterus, and two fingers gently passed between the placenta and uterus to separate the adhesions, and great care should be taken to bring away every portion of it.

Protracted Labours include lingering, difficult, and instrumental. They depend either on an insufficient power in the uterus, or undue resistance in other parts, and may be subdivided into cases which terminate by the uterine efforts, and those which demand the use of instruments.

Lingering or *protracted labour* may depend on *atony or feeble action of the uterus,* brought on by low diet and other debilitating causes.

The treatment will consist in administering mild nutritious diet, using friction over the abdomen, or giving moderate doses of opium; these are the cases which require the ergot of rye to be given in doses of gr. xx to gr. xxx of the powder, or an ounce and a half of a decoction made with two drachms to eight ounces of water, given every twenty minutes.

Plethora sometimes diminishes the proper contractions of the uterus, and requires the removal of blood from the arm.

An excess of liquor amnii diminishes the contractile power of the uterus by the over-distension which it occasions. The remedy consists in puncturing the membranes, either by a probe or quill, or scratching an opening through them with the finger-nail. This should not be done till the os uteri is well dilated.

Rigidity of the os and cervix uteri requires sometimes abstraction of blood from the arm, nauseating doses of tartar emetic, and purgatives. The French have recommended rubbing extract of belladonna over the os uteri, which is said to be very useful in producing dilatation, but is a practice not followed by British accoucheurs.

Rigidity of the external parts requires fomentations and the application of lard in the vagina. The perinæum is to be particularly guarded in these cases.

Distension of the bladder requires the introduction of the catheter to draw off the urine, and an accumulation of fæces in the rectum is to be remedied by the use of enemas.

Shortening of the Funis.—In this case patience is the only remedy, but care must be taken that the funis is not ruptured or torn from its insertion in the umbilicus. There are numerous other causes of lingering labour detailed by authors; and, amongst them, tumours of different kinds. The ingenuity of the accoucheur must supply the place of rules of treatment, which cannot be laid down for every possible case.

Labours which require Instruments.—If the uterus, after long continued efforts, loses its power, and is incapable of expelling the fœtus; or, when the fœtal head is impacted in the pelvis, and the natural powers are inadequate, recourse must be had to instrumental assistance. In using instruments compatible with the life of the child, there are a few general rules to be attended to:

Let the bladder and rectum be evacuated, the first by the catheter, the second by an enema, if required.

The os uteri must be dilated, and the external parts must be in a yielding state.

Introduce the instruments during the cessation of pain.

Use the instruments in such a way as to assist the natural efforts; that is, during the contraction of the uterus; if the powers of the uterus are lost, imitate nature in allowing short intervals of repose.

Employ the extracting power according to the axis of the various parts.

If pain is produced by the instruments, remove them, and replace them with greater caution.

Directions for applying the Forceps.—Place the patient at the edge of the bed on her left side; take the half of the forceps in the left hand, introduce the blade over the upper part of the child's head, guiding it with the index-finger of the right hand: then take the other blade in the right hand, and introduce it opposite to the first, and lock them together; when this is done, gentle traction may be used from one blade towards the other, keeping in mind the different bearings of the parts to be passed. Some practitioners introduce the lower blade first, and although the above rule is laid down by most writers on midwifery, I have myself found the introduction of the lower blade first, easiest and most convenient.

The *application of the forceps* is required in those protracted cases in which uterine action has ceased, or nearly so; or in which there is want of room, hæmorrhage, or convulsions, and in which it is requisite to expedite delivery. In all cases when the head is in the pelvis, the forceps should be applied in a direction from the occiput to the chin, or vice versâ; and in each case it is necessary to feel one of the ears, as it is over them that the instrument passes.

Face presentations are very unfavorable and tedious, and require particular management. If the chin is opposed to the pubes, and discovered early, the position may be rectified by depressing the occiput, and elevating the face with the fingers.

Presentations of the forehead and ear may generally be much assisted by mild application of the lever, used so as to depress the occiput and elevate the chin or ear.

The long forceps are requisite in those cases in which there is slight diminution in the natural size of the brim of the pelvis; and in cases of hæmorrhage or convulsions, when the child's head rests on the brim.

They must be applied in such cases over the occiput and face, and traction be used from side to side, remembering also the axis of the parts.

The *operation of craniotomy* is requisite in those cases in which the pelvis is deformed or distorted, in case of undue ossification of the bones of the cranium of the fœtus, or distension of the head by fluid. The Cæsarian section has been resolved upon in some such cases; and, in many, premature labour has been induced with success.

The distance between the pubis and sacrum must not be more than two inches and a half.

The *instruments* are the *perforator*, to make an opening in the head, and the *crotchet*, which is a sharp-pointed hook, or, in place of it, preference is now given to the craniotomy forceps of Dr. Davis or Mr. Holmes.

In performing this operation, the uterus must be fixed by pressure upon the abdomen; the operator then passes up two fingers in the vagina, to the head of the fœtus, guiding the perforator, which is introduced in one of the fontanels; the opening is then to be enlarged by a rotatory motion of the instrument.

The craniotomy forceps are then to be introduced, in order to grasp the bones of the head; and traction is to be used according to the axis of the parts to be passed.

If the head requires opening in face presentations, the perforator must be introduced just above the nose; and, if it is requisite after expulsion of the extremities, it must be passed in just above the ear.

Symptoms of death of the Fœtus in utero.—Immobility of the fœtus; sensation of weight; uterus relaxed and yielding; complexion sallow or pale; loss of appetite; uneasiness; diarrhœa; fever; and diminution in size of the breasts and abdomen.

The Cæsarian section is considered necessary, if, at the full period of utero-gestation, the distance from the symphysis pubis to the promontory of the sacrum be less than one inch and three quarters, and the largest diameter of the pelvis is less than two inches and a half.

It is also supposed that the fœtus is of full growth.

Place the patient on her back, cut down on the linea alba with a scalpel about the length of four inches, then divide the peritoneum with a blunt-pointed bistoury; cut through the uterus to the same extent and in the same direction; extract the fœtus and placenta through the opening, and apply a bandage gently around the abdomen. The section of the abdomen, named *gastrotomy*, is sometimes necessary if the uterus becomes ruptured, and the contents are forced into the abdomen, whilst the os and cervix uteri are not well dilated or dilatable.

It has been recommended to bring on labour prematurely, if it is ascertained that it is impossible for a child to be expelled alive at the full time. The operation consists in puncturing the membranes, or by introducing a finger to detach the decidua as far as possible from around the cervix uteri. Parturition comes on in a short time afterwards, and is to be managed according to the presentation, as in other cases.

The *feet* usually present in two positions; viz., with the toes towards one or other of the sacro-iliac symphyses; if they present towards the sacrum, or symphysis pubis, a turn must be made by grasping the nates, to give the inclination requisite for the head to pass through the brim. If the arms can be easily reached, they should be brought down before the head, and the finger may also be passed up to depress the chin, which will diminish the length of the axis of the head.

If one foot presents, endeavour to bring down the other, by placing a finger in the groin.

The *knees* presenting require the same management.

In preference to performing the Cæsarian section in cases of ruptured uterus, in consequence of the frequent unfavorable terminations, some accoucheurs recommend that nature be trusted to, for getting rid of the fœtus; which has been effected by a communication formed with the intestines, and the passage of the fœtus piecemeal.

Presentations of the *breech* are generally known by an escape of meconium, by the external organs of generation, and the anus.

These presentations require usually little manual assistance until the feet are brought down, and then they may be managed as footling cases.

There are other presentations, such as of the *upper extremities*, *back*, *abdomen*, *nape of the neck*, and *throat*, which require the introduction of the hand into the uterus to find the feet or knees, and bring them down by the operation called *turning*.

Vertex presentations, under peculiar circumstances, require to be managed in the same manner.

Turning is also requisite in *convulsions*, *dangerous hæmorrhage*, and *torpor of the uterus*. The operation of turning is thus performed; the patient may be placed as usual on her left side, the bladder and rectum must be evacuated, and the os uteri well dilated; then, during an interval of pain, introduce one hand into the uterus, rupture the membranes, then pass the hand carefully along the inside of the membranes, over the body of the fœtus, and take hold of the feet, which are generally towards the abdomen, grasp them, and bring them out of the external parts. Alter the position by giving the body a slight turn, from outwards inwards; disengage the arms, first the one behind; depress the shoulder, and pass the finger over the head and chin; give to the head its motion of flexion; place the fingers of one hand on the occiput, which recedes, and the fingers of the other hand on the face, to lower the head; repeat the turn, place the fingers of one hand near the mastoid process, those of the other on the sides of the chin; support the perinæum, and allow the face to emerge first.

If the *funis* presents, the object will be always to return it to the uterus, and to keep it there in any possible manner. A sponge has been sometimes used for that purpose; but this, as well as the other means recommended, is generally inadequate. If it cannot be returned, let it be placed in such a part of the pelvis as to make it least subject to pressure. Turning is sometimes resorted to in these cases, to save the life of the child at the earnest request of the mother.

Twin Cases. Management.—In cases of plurality of children, the principal object is to prevent hæmorrhage, which may arise from atony of the uterus, produced by excessive distension. When it is ascertained, after the birth of the first child, by examination per vaginam, and by placing the hand upon the abdomen, that there is another fœtus in utero, and uterine action does not come on after waiting a short time, the hand may be passed up to ascertain the presentation, and to rupture the membranes; if turning be requisite, it should be done immediately, and then it is proper to wait till contraction comes on. In extracting the placentæ, they should be brought away together by coiling the two cords about each other. Subsequently, a bandage should be carefully applied round the abdomen, and great care taken to prevent the occurrence of hæmorrhage, which is not uncommon from the large surface of the uterus connected with the placenta.

The symptoms of *convulsions* during labour are, pain in the head, vertigo, and loss of consciousness; oppression at the epigastrium, turgidity of the vessels, especially about the head and neck; hurried respiration, attended with a tremulous hissing noise; rigidity of the voluntary muscles during the paroxysm.

Convulsions occur more frequently in first labours, and generally depend upon plethora in an irritable habit, irritation of the os and cervix uteri, and indigestion.

The symptoms attending convulsions are found to vary, and hence puerperal convulsions are described by accoucheurs as of three kinds, which they name *apoplectiform*, *epileptiform*, and *hysterical*. The first variety is by far the most common, and requires the treatment below.

Treatment.—Relieve the plethora by bloodletting from the arm, temporal artery, or jugular vein; shave the head, and apply cold to it; give nauseants, such as tartar emetic; apply sinapisms to the feet or legs. Relieve the uterus as soon as possible. When dilatation of the os uteri ensues, expedite delivery, but by the mildest possible means.

Hæmorrhage occurs before, during, or after labour. When it occurs before, the treatment adopted is that for abortion, keeping the patient in the recumbent position, abstaining from heating food or drinks, and administering cold acidulated drinks. It most frequently comes on at about the seventh month, and depends upon the attachment of the placenta over or near to the os uteri.

Hæmorrhage coming on during labour, is either *accidental* or *unavoidable;* the first occasioned by a slight detachment of the placenta at some part of the fundus or corpus uteri, the second depending on its being placed upon and around the os and cervix uteri. In the first case, if the hæmorrhage is considerable, labour must be hastened by rupturing the membranes and turning; but, if it be slight, it will be better to wait and assist the uterine efforts.

In unavoidable hæmorrhage, the placenta is attached about the os uteri, which, being dilated, attaches a portion, and thus produces the discharge of blood.

If the placenta be attached rather on one side, the hand must be passed up by the space unoccupied, to grasp the feet and turn the child; but, if it is directly over the os uteri, the fingers and hand might be passed through its substance, in order to accomplish the object of turning: some recommend that in all cases the hand should be passed up on either side, and not through the substance. The rest of the treatment may easily be inferred. Dr. Simpson and some others recommend, as a general rule in placenta prævia, that the placenta should be entirely separated from its attachments, and allowed to escape into the vagina; by such treatment the hæmorrhage usually ceases instanter, but the child must of necessity be born dead.

Hæmorrhage after labour results generally from torpor of the uterus, depending on a variety of causes.

The general treatment consists in stimulating the uterus externally, by friction, or by passing up the hand internally, or in the application of cold.

Hæmorrhage takes place sometimes internally into the uterus, forming large coagula, which assist in stopping the mouths of the bleeding vessels.

The general treatment of all hæmorrhage is the same. Remove the exciting cause, place the patient in the recumbent posture, with the feet rather raised above the rest of the body; ventilate the room with cool air; administer cold, iced, or acid drinks; apply ice-cold wet napkins to the pubes and abdomen, and enjoin the greatest quietude. Introduce some cold body into the vagina, such as a piece of ice, to hasten the formation of coagula, plug the vagina, and apply a bandage gently round the abdomen.

In some cases, hæmorrhage takes place to such an extent as to leave the system incòmpetent to rally under any common modes of treatment. Transfusion has been recommended under such circumstances, affording the only hope of recovery.

The operation consists in injecting fresh-drawn human blood into one of the veins of the patient, generally the cephalic or basilic, to the extent of twelve or sixteen ounces. It must be done gradually, or it will bring on fatal consequences. (*Vide* Waller's 'Elements of Midwifery.')

Infants are sometimes born in a state of *asphyxia*, brought on by the continued pressure, or by a quantity of mucus filling up the mouth and fauces.

Treatment.—Before tying and dividing the cord, immerse the child in warm water, and dash a little cold water upon the face and chest; use friction over the heart; remove any mucus from the mouth, and inflate the lungs by blowing into the mouth, closing the nostrils, and pressing the larynx against the œsophagus at the same time; when the child happens to have suffered from plethora, some recommend that a little blood should be allowed to escape by the funis, and that cold should be applied to the chest by sprinkling of water, and to the face by blowing cold air upon it. The treatment recommended by Dr. Marshall Hall, in cases of suspended animation, known as "the ready method," may be most advantageously resorted to in these cases.

ELEMENTS OF BOTANY.

BOTANY is a branch of Natural History devoted to a consideration of the vegetable kingdom, in reference to the structure, varieties, and uses of plants.

The most important benefit derived from this study consists in acquiring a knowledge of the salutary and deleterious properties of plants, whereby they are rendered available for domestic purposes, in the arts, or in the practice of medicine.

Vegetables are organized living substances deprived of voluntary motion, having neither nerves, muscles, nor a central cavity like a stomach, and generally fixed to the ground, from which they derive nourishment and support. They are distinguished from animals by the above characters, by their mode of receiving nourishment, their chemical composition, and by the changes they produce in the elements of the atmosphere. Plants are supported by inorganic substances, as gases, water, salts, &c.; they contain an excess of carbon, and exhale oxygen gas in considerable quantity: animals are nourished by organized animal and vegetable bodies; they contain an excess of nitrogen, and exhale an abundance of carbonic acid, but never simple oxygen.

The vegetable kingdom, taken collectively, presents, to a superficial observer, an immense variety of distinct species, differing in dimensions and appearance; some being the growth and production of one year, others the result and produce of many seasons, extending in some cases to many hundred years. To the largest, most permanent, and solid forms, the term *tree* is applied; those of less size, but of more than one or two years' growth, and woody in substance, are called *shrubs;* but the soft tender vegetables which live but for a short period are named *Herbs.*

Vegetables are entirely, or in great part, composed of membranous cells, which are closed on all sides, more or less firmly cemented together, and surrounded in young plants by a membranous cuticle. Plants formed by cells exclusively are called *cellular;* those formed by it only in part, and into which cylindrical tubes called vessels enter, are named *vascular,* or having vessels.

Notwithstanding the difference of appearance in the separate parts or organs, they are all composed of certain simple structures, variously interwoven and arranged. These simple or elementary tissues are described by De Candolle as four, viz., cellular tissue, vessels, fibre, and epidermis, to which may be added some varieties of them less frequently developed. By the union and peculiar arrangement of these, the massive trunks of trees, branches, leaves, and all other parts of the vegetable are formed.

Cellular Tissue.

The cellular tissue consists of a congeries or collection of cells, various in their shape, adherent to each other, but in some cases admitting of separation without laceration. It is found in all plants, and some indeed are formed by it exclusively, as the Acotyledones. It surrounds the vessels of vascular parts, abounds in fruit, in fleshy leaves, in the medulla, and in the bark of the root; it is more plentiful in herbs than in trees, in young plants than in the old, and appears to constitute plants entirely at their first evolution.

The cells of this tissue are most frequently found to assume four different shapes, which are the *round, fusiform, tubular* or *prismatic,* and *transversely elongated.* The rounded form appears to be the original one, and it is probable that the shape of the others depends upon the pressure to which they are exposed: when equally pressed on all sides, the cells are hexagonal; but they are elongated and prismatic when the pressure is greater on either side of them. The *rounded* or hexagonal cells are found in the pith, in the cellular envelope of the bark, in the flesh of pulpy fruits, in the parenchyma of the leaves, and in every part of the vegetable which is not disposed to elongation. The *elongated* cells enter into the composition of the wood and cortical layers; they surround the vessels of vascular plants, and alone compose the ribs of leaves and peduncles; they likewise form the stems of the cellulares. The *transverse* cells form the medullary rays, and are peculiar to dicotyledonous plants; they are much smaller than the others.

The cells are in some places filled with an aqueous juice, in others with air, or with opaque coloured substances; thus they contain fecula in the fleshy cotyledons, in the farinaceous albumen of seeds, and in the parenchyma of tubercles. They enclose coloured particles in the various parts of a plant, and to this substance the term chromule is applied.

The cells of the alburnum and cortical layers contain granules of ligneous matter, which adhere to their walls, render them opaque, and produce the remarkable varieties found in wood.

There are spaces between the cells, called *Intercellular Canals* or *Passages*, varying in their form, but most frequently triangular; they have the same direction, being longitudinal or transverse; they are often filled with water or air, and appear to receive the proper juices.

The most remarkable property of the cells or vesicles is the power of uniting themselves together, which is one of the most important functions in the history of vegetation; on this depends the variety of appearances in the internal tissues, and the union or combination of all the different organs.

A second property of the cellular tissue is that of being excessively permeable to moisture, so as to absorb water brought in contact with it, and particularly that which is conveyed through the intercellular passages.

The third peculiar property of this tissue is that of organic contractility, without which it is difficult and nearly impossible to explain the course or circulation of the fluids.

Uses of the Cells and Intercellular Passages.—The cells being closed on all sides cannot receive fluids, but by a power of absorption in their walls. Those which are of a rounded form absorb the fluid or sap, and elaborate it in their cavity, giving rise to the production of fecula, mucilage, and colouring resinous matter; hence we see these substances abounding in the parenchyma of leaves and fruits. The elongated cells surrounding the vessels contain none of these substances, but appear generally empty or filled with air, thus partaking of the nature of vessels. The intercellular passages are generally full of fluid, and it is probable that they mainly contribute to its circulation. In respect to function, they may be divided into three classes:

1st. The passages between the cells surrounding the vessels are subservient to the ascent of the sap from the root.

2d. The passages between the cells of the medullary rays transmit the sap laterally, from the centre to the circumference.

3d. The passages between the rounded cells receive the sap in greater quantity, and the cells thus surrounded imbibe it for elaboration.

These passages, when dilated, produce most of the air, cavities and reservoirs of the proper juices of plants.

The Vessels.

The vessels which are found in plants have obtained numerous names from the different authors who have examined them, and have been divided in various ways, under erroneous impressions as to their functions and uses; there still remains great uncertainty on the subject. It is supposed by many that they are all modifications of one kind, and that they are merely different in appearance at different stages of a plant's growth. It is likewise supposed that they are formed simply by cellular tissue, assuming a peculiar vascular form; should they be convertible by age into each other, the spiral must be admitted to be the primary vessel, as it is the one which is always first seen in young plants. They admit of a division into five kinds, deduced from their external appearances:

1st. *Spiral vessels*, or *tracheas*, are tubes formed by laminæ of elastic tissue twisted into a cylindrical form, capable of being unrolled; or they may be said to be arranged like a riband rolled round a cylinder, forming by its folds a continuous tube. They are most abundant in young shoots; in the old trunks of dicotyledonous plants they are only seen surrounding the medulla, in the sheath of which they seem to form an essential part. In the stems of herbaceous dicotyledonous plants they are found near the centre; they are likewise found in the ribs, on the corolla, and in the sexual organs. They do not exist in the roots of vascular plants, nor are they found in any portion of the cellulares.

2d. *Annular* or *Radiated vessels*, with the aid of a microscope, present an appearance of simple cylindrical tubes, marked with transverse and parallel rays. When seen in the tissues, they look like tracheas which have not been unrolled; they differ, however, in not being capable of unrolling, in not being elastic, by their rays being parallel and not like spiral, and by being of different diameter to the tracheas when occurring in the same plant. Mirbel considers them to be tubes marked with parallel fissures, whilst others state that they are tubes furnished with opaque parallel rays, which, in their nature, bear an analogy to the punctuations in the dotted vessels. They are generally found in the woody portion of vascular plants, in all the layers of the Dicotyledons, except surrounding the medulla, and in each ligneous filament of the Monocotyledones.

3d. *Punctuated* or *Dotted vessels* assume the appearance of cylindrical tubes, the walls of which are studded with several series of opaque dots. They are most abundant in the Dicotyledones in the woody layers, the root, stem, and branches; and are found in the woody filaments of the Monocotyledones. Kieser considers them as formed by tracheas, or annular vessels, the spires or rays of which are united by a dotted membrane. Mirbel considers them to be perforated tubes; and Dutrochet affirms that they are membranous tubes, marked with dots, produced by prominent vesicles. De Candolle is of opinion that these vessels are membranous tubes, marked with glandular points.

4th. *Beaded vessels* are tubes marked transversely, with spots like the dotted vessels, and contracted at certain spaces, giving the appearance of a string of beads. Mirbel considers them to be cells placed end to end, with partitions between; these, however, are not found to exist, they may more easily be supposed to be modifications of the radiated vessels. Kieser regards them as spires or rings, considerably separated, but reunited by a dotted membrane. These vessels are common in the root, in the articulations or nodi, and in the commencement of branches and leaves.

5th. *Reticular vessels* are the most uncommon of all, and have been less the subject of inquiry. Kieser considers that they are produced by the spiral or annular fibres which form the tracheas and radiated vessels, unequally united together, and leaving between them empty spaces, or oblong holes; they are more common in the root than in the stem.

The spiral vessels are described by some botanists as subservient to the passage of the sap; this opinion, however, is feebly supported, for they are not found to contain any fluid, and moreover, in plants which have no vessels, the sap or juices ascend with as much and perhaps more facility than in those which are supplied with them. They are now more generally considered to be air-tubes, which are in some manner necessary to the vitality of the plant.

Fibres and Layers.

If the stem of a vascular plant be cut through, a certain number of hard compact points are seen; and if it be torn longitudinally, these points are found to be sections of longitudinal threads, to which the name of fibre is applied. These fibres are not simple or separate organs, but are composed of bundles of vessels, intermixed with, and surrounded by cellular tissue.

When many of these fibres are distributed circularly round an axis, the whole together obtain the appellation of a *stratum,* or layer. The layers are generally concentric rings, or cones, encased one upon the other.

The Cuticle and Epidermis.

The term epidermis or cuticle is applied to the thin transparent membrane which covers the entire surface of plants, except the stigma, and which admits of being separated from the other adjacent tissues with more or less facility. Two opinions have been entertained on its nature: one party considers that it is simple cellular substance, hardened by exposure to the light and air, and altered by the passage of fluids, and by evaporation. The other party considers that it is a peculiar distinct membrane, which enlarges with the vegetable, like the skin of animals.

The cuticle of leaves appears to be formed by a layer of cells, generally differing in their form from those of the common parenchyma, and which may, in this point of view, be considered a separate membrane, distinct from the subjacent tissues. It is of the same nature in the petioles, young branches, calices, corollas, and fruit; and in all parts at their first formation.

When a plant is first formed and exposed to the air, its cuticle generally presents all the stomata and hairs it is intended to be supplied with; hence they are thickly arranged, and are separated from each other in proportion as the surface enlarges; and this is the reason why leaves, when expanded, have apparently fewer hairs upon them than in the young state. This, however, in some cases, depends upon the pubescence falling off naturally.

When the young branches have attained their natural dimensions, they cease to be elongated, but begin to be thickened, and at this period the cuticle assumes a particular appearance. It first becomes opaque, then dries up and exfoliates; or is separated by cracking, caused either by evaporation and the action of the air, or by the distension produced by increase in the diameter of the trunk. About the second or third year its tissue is thickened; it does not present a decidedly areolar appearance. To the internal covering, when in this state, the term epidermis may be strictly limited.

The epidermis differs from real cuticle in having no stomata, or hairs, such as are abundantly found in the surface of leaves. It serves as a protection to the cellular covering of trunks in various ways. 1st. It diminishes evaporation. 2d. It prevents putrefaction, which might be produced by external moisture. 3d. It protects the cortex from the effects of frost, by means of its layers retaining a quantity of air between them, and thus offering an impediment to the rapid escape of caloric.

Stomata.

Stomata are orifices very visible by the aid of a microscope, on the cuticle of the greater portion of the herbaceous surfaces of plants. Their form is oval, sometimes round, and occasionally elongated; their border has an appearance of an oval sphincter, capable of opening and closing itself, and continuous with surrounding cellular structure of the cuticle. Some consider them to be terminations of vessels; others think they communicate with cells; but the most plausible opinion is, that they open into the intercellular passages.

Stomata exist in all the foliaceous surfaces of vascular vegetables, viz., the leaves, stipules, calices, and pericarps, which are not fleshy. The parts in which they are not found are the roots, old stems, petioles which are not foliaceous, most petals, fleshy fruits, all the seeds of vascular plants, and all the organs of the cellular plants. They are not found with any regularity as to number or situation; for in some leaves they are seen on the upper surface, in others on the lower, and in some plants on both. Parts, however, which possess most of the characters of the parenchyma of leaves are supplied with them in greatest quantity.

Stomata are likewise wanting in vascular plants which grow under water, in the leafy portion of bulbous plants which is inclosed in the bulb, and in vascular parasitical plants which are not of a green colour.

Their uses appear to be, to carry off aqueous fluid by a peculiar mode of transpiration, to assist in absorption under certain circumstances, and possibly to absorb air during the night.

Spongioles.

Spongiolæ, Spongioles, are very small spongy bodies of cellular structure, possessing an amazing power of absorption. De Candolle has described three kinds of them, which are the following:

Radical Spongioles, according to some *radical pores*, are found at the extremities of the little fibres of the roots.

Pistillary Spongioles exist in the stigma, and are the means by which the female organ absorbs the fecundating fluid.

Seminal Spongioles are found on the surface of the seeds, and are of use in conveying the moisture which causes them to germinate.

The peculiar distinguishing characters of these bodies are the following: they possess greater power of absorption than the rest of the cellular tissue; absorption takes place in them without any evident corresponding organization; and they absorb colouring matters which will not enter the stomata, although the openings of the latter are considerably larger.

Little tubercular bodies are found on the surface of the cuscutæ, called haustoriæ or suckers, which are of use in absorbing fluids from the plants upon which they grow. The minute structure of them is unknown.

Lenticels.

Lenticellæ, lenticels, or lenticular glands of some authors, are the little round or oval spots which are observed on the bark of the branches of trees. They are various in their form, size, and elevation, and are found on the bark of most dicotyledonous plants. When roots are given off from branches, they emerge from these places; hence they are considered to be root-buds. They neither absorb fluids, nor assist in evaporation.

Glands.

A gland, according to the present acceptation of the term when applied to botany, is understood to be a secreting organ, the use of which is to extract, from the common nutritious fluid of the plant, a juice of a peculiar nature. The term, however, is adopted too extensively by some authors, and applied to parts totally dissimilar in their properties and uses. There are several kinds of glands, but the following are most evident and most necessary to be enumerated:

1. *Glandulæ Urceolares*, or pitcher-shaped glands, are fleshy, of a tubercular form, concave, and emit a viscid liquid. They appear to be real excretory glands.
2. *Glandulæ Nectariferæ;* nectariferous glands are organs very various in their shape, and commonly known as nectaries. They secrete a liquid possessing the flavour of honey.
3. Glands found at the base of hairs, as in the nettle.
4. Glands situate at the apex of hairs.

Mirbel has taken a somewhat similar view of them, and from consideration as to their structure, has arranged them in two divisions, the *cellular* and *vascular*.

The cellular glands are composed of very fine cellular tissue, and have no communication with the vessels. They produce a peculiar fluid, whence they may be presumed to be excretory ducts.

The vascular glands are likewise formed by very fine cellular tissue, and are also crossed by vessels in different directions. They do not throw off any particular fluid; hence it is imagined that they prepare juices which are subservient to the uses of the plant.

The Hairs, or Pubescence.

Pili, villi, or hairs, are the soft little thread-like productions found on the surface of plants, and which make them rough and of a downy or velvety appearance. They are elongated glands, and differ from glands only in their form; they vary in shape, uses, origin, and structure. De Candolle makes five varieties of them, viz., glandular, lymphatic, such as are attached to the corolla, scaly, and radical.

Glandular hairs are of two kinds; glanduliferi, or such as have a gland at their extremity; and excretorii, which are tubes or continuations of some excretory gland, such as are found on the Stinging-nettle.

In all glands which are supplied with excretory hairs, the liquid secreted is of a caustic irritating nature; and this liquid, which never escapes naturally, is only directed to the aperture at which it escapes when pressure is applied to the part containing it. This defensive organization bears a strong resemblance to the structure of the fangs of venomous serpents.

Lymphatic hairs, or such as are not united with glands.—These are very common, and form the common pubescence of plants. They vary in their direction, being vertical or perpendicular, bent forwards or backwards; and, in their shape, being cylindrical and conical. Lymphatic hairs are not found on roots, or parts excluded from the air; they are sometimes found on young branches and stems, but are most common on the surfaces of leaves, stipules, and calices; and particularly on their under surfaces. They are likewise found on peduncles, petioles, and the outside of pericarps. They are most abundant in plants which grow in hot places, and which are dry and exposed to the sun. They are considered by some to facilitate evaporation; but they would rather appear to preserve the plant from too rapid evaporation. They are likewise a protection against cold, external moisture, and the attacks of insects.

Pili Corollini, or hairs of the corolla, are found on the petals, calyx, stamens, and styles; on the corolla of the Cucurbitaceæ; on the Menyanthes, &c. They admit of the same varieties in form as the lymphatic hairs. Their origin and uses are still unknown.

Pili Squamosi, scaly hairs, are of a dry or scaly nature, and appear like dead substance, possessing no power of absorption. They are found on the petioles of Ferns, the compound aigrettes of the Dipsaceæ, the appendages to the glumes of Grasses, &c. They form what is commonly known as the pappus, which is of use to convey seeds to distant countries.

Pili Radicales, hairs, are sometimes found upon the roots, but never in plants which grow in the water. They are supposed to absorb air, and resemble true hairs in their form and structure.

The Articulations and Dehiscences.

The term articulation, in plants, is applied to the points where, at a certain period of vegetable growth, solutions of continuity take place; thus all parts which fall off naturally are supplied with articulations; whereas those which are not, perish at a certain time, are dried up, and fall to pieces, but are never detached in one entire portion.

When an articulation is dissected in the young and fresh plant, we see in it vessels and cells, regular and continuous with those adjacent, but there is observed a prominence or nodosity indicating the point of the articulation. After a certain time the nodi increase, and a layer of cells and vessels arranged on the same level is dried up and obliterated, and separated from the adjoining ones. The fibres alone, at that time, keep up a communication; these, not being bound and cemented together, by the surrounding cellular tissue, are easily torn with the slightest force. The part exposed by the falling off of the dead organ, previously attached by an articulation, is called a *cicatrix*.

The term dehiscence is used in the same sense as articulation, but applied to hollow organs, in which separation takes place longitudinally. Thus most dried fruits, when ripe, open longitudinally or transversely, by one or more regular separations. The places where they take place are generally indicated by rather prominent linear eminences, to which the term *suture* has been affixed. In other cases there is no line or indication of the part to be ruptured, but this take place in the organ where there is the least resistance. This phenomenon is called dehiscence by rupture.

Division of Vegetables.

Vegetables admit of a division into classes, simply from a consideration of the elementary organs.

In this point of view they may be divided into cellular and vascular; the former solely composed of rounded or elongated cellular tissue; and the latter consisting of cellular tissue and vessels.

Cellulares, cellular plants, are constantly without stomata; they present an uniform homogeneous mass, and their organs of nutrition and reproduction are slightly developed. They have besides but a weak tendency to a perpendicular elevation.

Vasculares, vascular plants, are generally furnished with stomata; their organs of nutrition and reproduction are well developed, and they have a constant tendency to the vertical direction.

The *Cellulares* are designated also by the terms *Acotyledones*, *Agamiæ*, and *Inembryonatæ;* and they form part of the class *Cryptogamia* of Linnæus. The *Vasculares* are synonymous with the *Phanerogamiæ*, *Phænogamiæ*, and *Embryonatæ*.

Two grand classes may be formed by a division of the vasculares into, 1, *Monocotyledones* or *Endorhizæ;* and, 2, *Dicotyledones* or *Exhorrhizæ*. In the first, all the vessels and elongated cells are placed longitudinally, and the new fibres are developed or deposited on the inside of the older or first-formed layers. In the second, the vessels and bundles of elongated cells are situated either longitudinally or transversely, and the woody fibres are formed on the outside of the primary layers or deposits.

The combination or union of the elementary tissues, variously interwoven and blended together, gives rise to the formation of the different distinct organs of a vegetable. The most important of these organs are considered as fundamental, and are the stem, root, and leaves, which are alone necessary for the common support of a plant. These fundamental organs, by being modified in various ways, form the other organs, of which there are two kinds, viz., *reproductive*, or such as are subservient to the reproduction of a plant; and *accessory*, or such as give support to the entire plant, or to separate portions of it.

FUNDAMENTAL ORGANS,

OR ORGANS NECESSARY FOR NUTRITION.

These parts of the vegetable may be considered as general or common to all species, although, in some instances, they appear imperfect and indistinct. In vascular plants they consist of the *stem*, *root*, and *leaves;* but in the Cellulares they are more or less blended together.

The Stem.

The stem is that portion of the plant which extends from the root to the leaves, and has always a tendency to a vertical direction. It is found in all vascular vegetables, but is sometimes so short that botanists have considered it to be wanting, and, in such cases, have named plants *Acaules* or *stemless*. In these, the leaves and flowers seem to emerge from the root, and are called radical, because their bases entirely conceal the stem, from which they are given off. Many plants of this kind, under favorable circumstances, produce stems of a very decided character.

The globular body of the Cyclamens, commonly called a tuberose root, is a real stem, for it gives off roots from its under surface, and leaves with flowers from its upper one. This opinion is confirmed by its mode of germination, and by its acquiring a green tinge when exposed to the light.

In bulbous plants, the part which may be considered as a stem consists of that flat rounded portion at the base of the bulb which, on one surface, supports the leaves, on the other the roots.

Many short and stunted stems are subterraneous, and acquire a great resemblance to roots, for which reason they claim the name of *Rhizoma*, a word which implies a resemblance to a root. Such are found in the European Ferns, in the Arums, &c.

The ramifications or divisions of a stem are called *rami*, or branches, to which, taken collectively, the term *cyma*, or head, is applied. Each branch may be considered as a separate entire individual, grafted on the trunk from which it derives its existence.

The stem at all periods bears the leaves, which will, at an after period, show themselves; and there are no stems without leaves, excepting in plants which bear none on any portion of their surface, as in the Orobanches, &c. The stalk of the Hyacinth is not a stem, but a peduncle rising from a stem, which is nearly imperceptible.

Hard knotted parts are found on some stems, from space to space, as in the Grasses, and are called nodi; to the spaces between them the term internodial is given. From these places, in plants possessing them, the leaves generally emerge. They are formed either by a plexus of vessels and fibres, or by a deposit of stony concretions.

These nodi may by some be readily mistaken for articulations, from which they are readily distinguished. The former are harder and more resisting than the rest of the tissue, whereas the latter are softer, less resisting, and more easily broken.

The duration of stems has given rise to a division of vegetables into annual, biennial, and perennial: annual plants and their stems are herbaceous; biennial plants die away after the second year; but perennial vegetables live for a considerable number of years.

Other botanists, who have not distinguished stems from a knowledge of their anatomy and functions, have included amongst them parts to which the term is not at present restricted.

They arrange them under five heads:

1st. *Truncus*, a Trunk, or woody stem of trees, belonging to the Dicotyledones, growing smaller at the top, and dividing into branches.

2d. *Stipes*, a Stipe, the fibrous stem of monocotyledonous plants, of equal diameter, or in some cases rather larger at its summit, seldom bearing branches, and generally terminated by a large expansion of leaves.

3d. *Culmus*, a Culm, or Straw, the knotted stem of Grasses. It is generally hollow, and bears leaves, which form sheaths round the stem.

4th. *Scapus*, a Scape, or Stalk, a kind of radical peduncle, springing directly from the roots, bearing the flowers, but not the leaves, straight and herbaceous, as in the Colchicum autumnale.

5th. *Frons*, a Frond, is by some considered as a stem, but requires a separate consideration. The leaves and fructification are found on the same part. The term is now most frequently applied to the expansion of those vegetables, the leaf and stem of which are blended and indistinct, as in the Lichens, Ferns, &c.

The Stem of Exogenous or Dicotyledonous Plants.

The structure of the stem of this division of vegetables is the most complicated, but at the same time its layers are very distinct, so as to admit of easy illustration and description. The order in which the layers are arranged, proceeding from the cuticle to the centre, is as follows: Cuticle, Epidermis, Cortex, Liber, Alburnum, Duramen (or Hardwood), Medullary Sheath, and Medulla (or Pith).

The *Cuticle* covers all parts which are woody, extending over the trunk, branches, and roots. It is transparent, and falls off in time, in the form of scales, or in hexagonal masses; it is sometimes covered with a glutinous substance, which assists in preserving the tree. Striking varieties of it are found on the following plants: in the currant and elder tree it is smooth, and scales off in large flakes; it is woolly on the peach, and on the leaves of the willow; and hairy on nettles. It is covered with a resinous exudation on the plum; is sometimes covered with a fungus, forming cork: and contains flint in some instances, as in the Equisetum hyemale.

The *Herbaceous Envelope*, or cellular substance, called by some Epidermis, analogous to the rete mucosum of the human body, is found external to the cortical layers; its cells are generally rounded and regular, and filled with a greenish resinous matter, which in the leaves fills up the spaces between the ribs, and is then called *Parenchyma*. This membrane is of use in separating transpiratory fluid, and in it the decomposition of carbonic acid takes place. Trees which part with this covering lose it at a certain regular period.

The *Cortex*, or cortical substance, consists of the layers situated underneath the cellular envelope, and is composed of a network of elongated cells, which are formed by the outer layers of the liber. Its organization is analogous to that of the woody portion, but its layers are formed in an inverse direction. They are fibrous internally, and cellular externally, and are traversed by the medullary rays.

During the first year of growth a stem has one ligneous and one cortical layer; in every successive year a new layer of each is formed on the outside of the woody part, but on the inside of the cortex. The layers of the latter, in course of time, are dried up and crack, and fall off in detached pieces, seldom presenting a series of accumulated layers representing so many productions of separate years.

The peculiar virtues of most barks reside in the cortex.

The *Liber*, which may be considered as a new or young layer of cortex, consists of a vascular network and elongated cellular tissue. Its layers in some trees may be separated by maceration, so as to resemble the leaves of a book, and hence its name is derived. This portion of the vegetable is one of the most important, for on it many of the phenomena of vegetation depend. During the season of vegetation, if the cortex be cut through, a thick liquid issues from the incision, and hardens, becoming green, and forming a layer of new bark. The liquid supplied by the liber is called *cambium*. If the circulation be stopped in the stem by a ligature, lumps raise themselves, and a bud is formed in any part where the fluid can most easily find an exit, thus showing that exogenous stems increase in diameter by means of the sap flowing downwards.

The *Alburnum* and *Duramen* form that firm hard portion of the stem known as the wood. The duramen, which is the deepest-seated central portion, is generally of a deeper colour than the alburnum, and is harder in its texture; its intercellular passages are in a great degree obliterated. They are both composed of radiated and dotted vessels, and elongated cellular tissue, and their consistence is produced by a deposit of hard woody particles in the cellular cavities.

The duramen and alburnum are the principal and nearly the sole support of the tree; they serve also as a medium for the fluids to pass up from the roots through the intercellular passages existing in them.

The *Medullary Sheath* is the woody layer immediately surrounding the medulla or pith. It seems to consist of a cylindrical or angular tube, extending from the top to the bottom of the tree, but, like the pith, branching into as many parts as there are ramifications. Spiral vessels are found in it, at nearly all periods of its existence

The *Medulla* or *Pith* is a dry, light substance, composed of cellular tissue, the cells of which are more regular, larger, and more dilated, and of a more spongy nature than in any other part of a plant. They have external communications by means of the medullary rays, which are composed of cellular tissue elongated in a horizontal direction. The pith is very large in young plants, but in old ones seems to disappear altogether. The uses of the pith are not agreed upon, but De Candolle conceives that it is a reservoir of nourishment for buds until they expand into leaves, and derive their support from other sources.

The Stem of Endogenous Plants.

These stems are never composed of two distinct substances, like cortical and ligneous, but present a more uniform homogeneous mass; they have no real medullary canal, nor distinct medullary rays; their oldest fibres are found on the circumference or outside, but the newest internally or in the centre, and for this reason they are termed endogenous, or formed in the centre. The structure of these stems is more simple than that of the exogenous, but, at the same time, more varied in form and appearance.

The stems of Palms, which, from their general appearance, have been more studied than most other endogenous stems, are composed of fibres connected by cellular tissue; those in the circumference being firmer, more closely arranged, and older; those in the centre are softer and more distinct, and present rather an herbaceous appearance. Each fibre consists of a bundle of spiral vessels, radiated and dotted vessels, blended with elongated cellular tissue, and surrounded by rounded cellular substance.

The Culmus, Straw, or Stem of the Gramina, differs from other endogenous stems in this respect, viz., that at the origin or base of each leaf a *nodus* or knot is found. Between the nodi or knots no leaves, branches, or roots are ever given out; but on the other hand, in the knotty part, the centre, which is occupied by cellular tissue, has the fibres crossing in an horizontal direction; they produce stem-clasping leaves, in the axilla of which a bud is produced. This, however, is only developed under unusual and very favorable circumstances. From these nodi likewise adventitious roots are thrown off, when the stems are near the ground or subterraneous.

The Root.

The root is that portion of the vegetable which fixes it to the earth, and is the principal organ of nutrition. Roots generally grow downwards in an opposite direction to the stem, and seek darkness and moisture. They vary in their periods of growth, being annual, biennial, and perennial. It is remarkable in roots that, unlike all other parts of a plant, they never become green when exposed to the action of light and air. Some roots float on the water without ever touching the bottom; others attach themselves to the surface of trees and rocks, from which they absorb the moisture; and there are others which penetrate into the substance of the bark of trees, and are nourished by their sap: plants with such roots are called parasites. Many parts of a plant are capable of producing roots. If a branch of some trees be cut off and placed in the ground, in a short time its lower extremity will be studded with little fibres. Roots are sometimes found at the extremities of leaves, and over the whole extent of some climbing plants, at the nodi of the Grasses, and in the axillæ of many aquatic plants. Thus we can account for the benefit derived from rolling the young grass, which, being brought in closer contact with the ground, throws out fresh roots from its nodosities, and in this way forms a new set of plants.

Roots are distinguished from stems by many marked characters; there is a total absence of spiral vessels and stomata. The internal structure of the roots of endogenous plants differs but little from that of their stems, for they are made up of dotted and radiated vessels, intermixed with cellular tissue. The difference between the two, in exogenous plants, is much greater: in the roots there is no medullary canal or pith; the ligneous or woody part is thinner in proportion, but the cellular envelope and cortex are much more developed. Branches are produced from buds, which are productions continuous with the entire bark; whereas roots shoot out without buds, and when they are given off from stems they spring from the lenticels, which never give origin to branches. The branches are generally given out in a regular order, and analogous to that of leaves, but the roots are generally not given out with any determinate precision. There are articulations in the branches, but none in the roots; and when nodi are found on them they are very different from the nodosities of stems and branches.

The root is commonly described as consisting of three parts, viz., the *Caudex*, body, or middle portion; *Collum*, the neck, or the part which unites it with the stem; and *Radiculæ*, or rootlets, which are the fibrous terminations. The variety in these forms has occasioned an arrangement of them into the following seven classes:

Radix Fibrosa, composed of numerous fibres, as in the *Grasses*.
Radix Repens, a creeping root, as in the *Mentha Pulegium*.

Radix Fusiformis, spindle-shaped, as the *Carrot*.

Radix Præmorsa, an abrupt root, or one which appears as if bitten off, as in the *Scabiosa Succisa*.

Radix Tuberosa, a tuberous or knotted root, as in the *Potato*; but this is now defined by Professor Lindley to be the expansion of the internodial spaces of an underground stem.

Radix Bulbosa, a bulbous root, a term erroneously employed; however, they are described as of three kinds: *solid*, as in the Crocus; *lamellated*, as in the Onion; and *squamous* or *scaly*, as in the Lily. The lamellated or scaly bulb is now considered to be a bud, which is defined as a growing vital point, extending itself upwards in the form of stem, downwards in the form of root, surrounded by scales or rudimentary leaves.

The solid bulb is now termed a cormus, as in Colchicum, Crocus, &c., and is described as consisting of the expansion of the underground stem of a monocotyledonous plant.

Radix Granulata, a granulated root, as in the *Saxifraga granulata*.

The Rhizoma, described by some as another variety of root, is a horizontal stem, which gives out rootlets from its under surface and leaves from the upper.

The uses of the root are to fix the plant to the ground, and to supply the greater portion of the fluids necessary for its nutrition. The absorption takes place solely by the rootlets, which are terminated by little absorbing bodies, called spongioles.

Many tuberous roots afford a supply of nourishment for the plant, in case of accident, when nourishment ceases to reach it, or at the period when the leaves, not being developed, cannot act upon the fluid, as in the early spring time, or, lastly, at the time when the ripening seeds require a superabundance of alimentary matter.

The Leaves.

The leaves are those flat expansions which grow laterally from the stems and branches of plants, and form one of their principal ornaments.

In a physiological point of view, they are the principal organs of evaporation; they decompose carbonic-acid gas, and produce changes in the juices, and are consequently the most important agents in nutrition.

Anatomically considered, a leaf is the expansion or unfolding of one or several fibres, which detach themselves from the general mass of the stem, and separate themselves in such a way that each vessel is distinct from the others, and has its proper orifice more or less isolated.

A leaf is generally described as divided into two parts, the flat expanded portion called the *limb*, or lamina, and its footstalk, or *petiole*. The limb is composed of an upper and under surface; the cellular soft substance interposed between them, called *Parenchyma* or *Mesophyllus*, and the ribs or branches from the petiole. The upper is distinguished from the under surface by being smoother; it is of a deeper green colour; its veins are less prominent; it is less pubescent, has fewer or no stomata, and its cuticle is more adherent. The under surface is characterised by opposite qualities; its ribs or veins are prominent, it is considerably pubescent, has numerous stomata, and is of a paler colour, from its cuticle being less adherent. This rule, however, does not apply universally, for in some water-plants stomata are found only on the upper surface, and in some herbaceous plants both surfaces are, to all appearance, exactly similar.

The ribs are little fibrous lines which are given out from the petiole, and ramify through the limb, like the bones of a skeleton. The term veins is sometimes applied to the ribs, if they are but slightly prominent, and little sensible to the touch.

The difference of direction in the distribution of these veins is a mark of distinction between exogenous and endogenous plants. In the former they ramify in the parenchyma of the leaf, in no precise order, and form an appearance of network; but in the latter they run parallel to each other, and are united by separate transverse little branches.

A *petiole* is called simple when it does not terminate with a tendril, and bears one leaf only; it is called branching when it terminates in several tendrils; and common when it serves as the base of insertion to several lesser petioles.

The petiole obtains various epithets, from its form and situation. It is called dichotomous when it divides into two portions, and trichotomous when it divides into three. The petioles are accompanied also by little appendages called stipules, which partake of the character of leaves.

The leaves are of different kinds, in respect to the period of their growth and importance. They are seminal, primordial, and characteristic.

By *seminal* leaves are understood the cotyledons. *Primordial* leaves (*folia primagenia*) are the leaves which first appear after the cotyledons, and bear some resemblance to them.

Characteristic leaves are the ordinary leaves of a plant, and, from being generally of definite forms, afford excellent distinctive characters. They are simple and compound. The simple leaf has a single limb, which admits of great variety in its form, surface, and colour.

Compound leaves consist of a number of little leaves, which are attached to one common petiole.

The absorption of fluids and gases by leaves principally takes place in their under surface. The upper surface, which is more smooth, is a medium for the excretion of useless fluids and gases, and to this function the term transpiration is usually applied.

The decomposition of the *carbonic acid* of the atmosphere principally takes place in the *parenchyma;* the air penetrates, and combines with the gas contained in the under surface; light decomposes them, fixes the carbon, and disengages the oxygen. The reverse takes place when plants are kept in the dark. *Leaves* are the principal seat of irritability, which has been proved by various experiments. The *leaflets* of a large number of *leguminous plants* close at the approach of night, and open the following morning, as if refreshed by sleep. The *leaves* of the *Hedysarum gyrans* are subject to a constant movement, which appears to be spontaneous, or independent of external agency.

Leaves generally are annual, but there are some which remain on the plant for a much longer period, even for the space of two or three years.

The provisions made by nature to remedy the injury sustained by a tree from the loss of its leaves are also subjects worthy of consideration.

If a tree be robbed of its leaves during the season of vegetation, the mischief is partly remedied by the buds (which were latent in the axilla of the leaves, and which would not have been developed before the following year) receiving a rapid increase, and forming fresh leaves. If by misfortune this does not take place, the tree generally perishes.

When a plant is naturally without leaves, the use of those organs is supplied either by another organ of the same plant, or by means of another plant.

The absence or diminution of the limb is supplied—

Either by a dilatation of the petiole, by means of which its fibres are more divided, the cellular tissue is expanded, and the stomata are exposed: this is generally observed in plants wanting the limb;

Or by an enlargement of the stipules or foliaceous appendages;

Or, in plants where the leaf is totally wanting, or falls off prematurely, the parenchyma of the bark of the young branches alone supplies its place: in these cases the cellular envelope is unusually developed, and the stomata are more abundant.

To parasitical plants, where the bark is not changed in its functions, and in which leaves are wanting, or are transformed into scales incapable of the functions of leaves, a power is given of implanting themselves on vegetables supplied with leaves, and of appropriating the sap elaborated by them.

Foliaceous Appendages.

The parts commonly described as leafy appendages are, Stipules, Tendrils, Glands, Thorns, Prickles, and Hairs, or Down.

Stipules are those leafy portions, like little wings, found at the base of the true leaves. They are generally considered as abortive leaves, and, to a certain extent, they enjoy the same functions.

Tendrils, supposed to be abortive petioles, or terminal leaves, are the spiral-twisted appendages, such as are found attached to the stalks of the grape-vine. Their principal use is to keep the plant in its position, by entwining themselves around some firm adjacent body.

The *Glands* resemble similar organs found on other parts of a plant.

Thorns, found on leaves and some other parts of a vegetable, proceed from the wood itself.

Aculei, Prickles, are productions of the cortical part only, and come away with it. Both these appendages are a considerable protection against the aggressions of animals.

Pili, Hairs, as before mentioned, are organs of absorption or exhalation. In the Nettle and some other plants, they are excretory ducts to certain glands, which secrete an acrid irritating fluid.

ORGANS OF REPRODUCTION.

The organs of reproduction by fecundation, in vegetables, appear only at a certain period of their growth, and are generally known as the flower, with its coverings and contents. The separate portions of these organs are generally considered as seven in number, four of which are proper to the flower, viz., the *Calyx, Corolla, Stamens*, and *Pistils;* two belong to the perfect fruit, as the *Pericarp* and *Seeds;* and one common to both, viz., the *Receptacle.*

Inflorescence, or the arrangement of the Flowers of Phanerogamous Plants.

The term inflorescence is applied to the arrangement of the flowers on the part which bears them, and may be described as of two kinds, the simple and compound.

By simple inflorescence is understood the position or situation of single flowers. They are *cauline, foliaceous, pedunculate, sessile, axillary, binate, ternate, alternate, scattered, opposite, erect, nodding*, or *pendulous.*

By compound inflorescence is understood the peculiar arrangement of a number of flowers collected together. The principal varieties may be arranged under the following heads:

1. *Amentum*, a Catkin, is an assemblage of floral scales or bracts placed round an axis, which is generally of some length, slender, and dependent. The apex of each scale covers the base of another, and beneath are found the stamens or pistils attached to the base. The catkin may be either male or female. In some works it is described as a variety of *Calyx.*

2. *Spica*, a Spike, is an elongated collection of flowers, either sessile or having short peduncles attached to a common axis, as in the several species of *Veronica.*

3. *Racemus*, a Raceme, or Cluster, is an assemblage of flowers or fruit, rather distant, with longer pedicles than in the spike, connected by a common stalk, as in the *Currant.*

4. *Panicula*, a Panicle, is a loose collection of flowers with long pedicles, somewhat like a bunch or cluster, as in the common *Oat.*

5. *Thyrsus*, a Bunch, is a dense collection of flowers, of a pyramidal form, as in the *Lilac*.

6. *Corymbus*, a Corymb, is a collection of flowers in which the lower primary flower-stalks are long and unequal, the upper ones short, so that all the flowers attain about an equal level, as in the *Yarrow*.

7. *Cyma*, a Cyme, is a species of irregular umbel. In it the primary peduncles divide into secondary ones, and these give out smaller ones, so that all the flowers are nearly on an equal level, as in the *Laurustinus*.

8. *Fasciculus*, a Fascicle, is a close group of straight flowers, of about the same length and size as the *Sweetwilliam*.

9. *Umbella*, an Umbel, or, according to some, a compound Umbel, is known by all the peduncles, of equal length and size, arising and diverging from a single point. The peduncles are divided at their extremities into pedicles, which likewise unite at their base. The whole together form a kind of hemisphere, resembling an open umbrella, as in the *Hemlock*.

10. *Verticillus*, a Whorl, is a collection of flowers round the stem, in the form of a ring, as in the *Dead Nettle*.

11. *Capitulum*, a Head or Tuft, is a globular collection of sessile flowers, as in the *Globe Thistle*.

12. *Calathidis*, or *Cephalanthus*, is the name given to the arrangement of compound flowers. They are sessile, on a common receptacle, and are surrounded by a common involucre or calyx.

13. *Strobilus*, a Strobile or Cone, is distinguished by a collection of coriaceous or ligneous bracts, of a hard consistence. It is found on the female heads of the *Coniferæ*, and in the *Hop*.

14. *Sertulum*, is a collection of flowers, each on a separate peduncle, and all arising from the same point. An example of it is found in the *Primrose*. This may be considered as a simple Umbel.

The Flower.

The flower is that temporary portion of the vegetable which contains the parts of fructification, with or without an envelope. In point of structure, a flower is defined by De Candolle as the assemblage of several whorls of leaves (generally four), variously transformed, and placed in the form of a terminal bud, at the extremity of a branch called a Pedicle.

A *complete* or *perfect Flower* consists of five parts, which are the *Pistil*, the *Stamens*, the *Corolla*, the *Calyx*, and the *Receptacle*.

If any of these parts be wanting, the flower is called incomplete. A perfect flower is always hermaphrodite, but imperfect flowers may be female or barren.

Pistil.

The pistil is usually described as divided into three parts, the *Germen*, *Style*, and *Stigma*. The *Germen* is the enlarged base, called ovary; which contains ovula, or embryos of the seed, and admits of great variety in its form and mode of insertion.

The *Style* is the slender filamentous part situated between the *germen* and *stigma*. It is sometimes wanting, and the *Stigma* is then called sessile. *Styles* are sometimes very numerous, and vary greatly in their shape.

The *Stigma* is the summit of the pistil, generally tumid and gummy, prepared to receive the fertilising pollen, and is devoid of cuticle.

The *stigma* has an orifice in its summit, and a cicatrix is always evident in it. It is covered with moisture, to retain and swell the fecundating *pollen*, which possesses a singular property of bursting as soon as it comes in contact with watery fluids. The *style* is perforated through its centre, to transmit the fertilising fluid to the *germen*.

The *Germen*, or *Ovarium*, situated beneath the *style*, contains little ova attached, by an *umbilical cord*, to a *placenta*. The pistil is described by most modern botanists as being a modification of one or more leaves, called *Carpels*, the under surface of which forms the outside of the ovarium, the upper surface forms the inside, and the margins give rise to the ovula or seeds.

The *Pistil* is composed of *air-cells*, porous vessels, and elongated cellular tissue. The vessels of the parent plant enter into it freely, and convey to it nourishing juices.

By excess of nourishment, a *pistil* may be metamorphosed into a *petaloid* expansion, and consequently become barren.

Stamens.

The *Stamens* consist of a *Filament* and a head called *Anther*. They arise from the receptacle, and are generally arranged with great regularity.

The *Filament* is the part formed like a little pedicle, which bears the anther. It is in substance like the petals, and when articulated upon the receptacle it falls off after fecundation; but if not, it dries up without falling, as in the Campanula.

The *Anther* is the little sac which surmounts the filament, and is generally full of a yellow dust, called *pollen;* it most frequently consists of two bags, united together; this point of union is called connectivum.

The *Pollen* is composed of a little membrane, forming a kind of bladder, and filled with the fecundating fluid; these portions of *pollen* are so small that they look like particles of fine dust. If one of them be placed on some water, it swells, bursts, and throws out a liquid matter called the fovilla, somewhat resembling oil in its properties. When the pollen falls upon the stigma, it emits a tube which passes down the style to fertilise the ovules.

The *Filament* is of the same substance as the corolla; sometimes it is hollow, at other times it is filled with air-vessels. Its only use is to support the *anther*, and to retain it in the position most favorable for the performance of its functions.

Corolla.

The internal envelope of the flower is called the *corolla*, and the same term is used when there is but one floral envelope, and it is coloured and unlike the leaves, although in this case Professor Lindley insists upon it being called calyx.

The corolla is called *hypogynous* when it is inserted beneath the germen, *perigynous* when it is inserted into the sides of the ovarium, and *epigynous* when it is inserted into the summit of the germen. If the corolla is formed of one undivided piece only, it is called *monopetalous;* if it consists of several, it is called *polypetalous*. The corolla admits of great variety in its form. Its varieties may be arranged in the following order:

1. *Regular monopetalous corollas* are *funnel-shaped, bell-shaped, globular, bowl-shaped, wheel-shaped,* and *star-shaped.*

The general parts of a monopetalous corolla are the tube, throat, and limb.

The *tube* is the lower portion, and is always straight; its orifice is called the *throat*. The upper expanded part is called the *limb*.

2. *Irregular monopetalous corollas* have the limb divided into two unequal parts; they are named *ringent* and *personate* flowers.

Ringent flowers always contain naked seeds, which are found at the bottom of the cup.

The seeds of *personate flowers* are always contained in a capsule.

3. *Anomalous monopetalous corollas* are those which cannot be referred to either of the above heads.

4. *Regular polypetalous corollas* have several petals of the same length and size, as in the cruciform and rosaceous flowers.

The petal of a polypetalous corolla consists of two parts: the lower thin part is called *unguis*, or claw; and the expanded portion *lamina*, or border.

The petals in general are of the same number as the sepals, or divisions of the calyx, and are not placed opposite to them, but in the intermediate spaces.

5. *Irregular polypetalous corollas* are of two kinds, the papilionaceous and orchidean.

The *papilionaceous* corolla is composed of five petals, which have received different names.

The upper one is called *vexillum*, or *standard*; those on the sides, are named *alæ*, or *wings*; and the lower ones, generally united, form the *keel*, or *carina*.

The corolla of plants of the Orchis tribe is composed of six petals, five superior and one inferior.

6. *Anomalous polypetalous corollas* are formed of numerous irregular petals, which cannot be referred to either of the above descriptions. Such are those of the *Violet*, *Larkspur*, and *Aconite*.

The *corolla* is said to be a continuation of the ligneous substance situated under the bark, or may be said to be formed by modified leaves; it is formed principally of cellular tissue and vessels, and has seldom any glands. Both in light and darkness it exhales carbonic acid gas and never oxygen; hence its deleterious properties. It immediately encloses and protects the fecundating organs.

The term *corolla* has been abolished by some botanists, and this alteration has given rise occasionally to much inconvenience; for one will be describing a *corolla* of a plant very minutely, whilst another botanist describing the same, states that it is deficient. It should be recollected that Monsieur Jussieu always uses the term calyx superior for corolla.

In the Aconite and Hellebore the coloured portion is now called calyx, and the bodies, before named nectaries, are considered to form the corolla.

Calyx.

The flowercup, or external covering of the flower, is generally of the texture of the leaves. Its divisions are by some called *Sepals*, by others *Phylli*, or leaves, and hence the terms *monophyllous*, *polysepalous*, &c. Calices have been classed in the following manner:

1. *Perianthium*, a perianth, the most common and general form of calyx is contiguous to and forms part of the flower, as is seen in those green leafy parts which surround the *rose*. *Tulips* have no calyx at all in the ordinary sense. There are plants which have a double perianth, as in the *Marsh mallow*.

2. *Involucrum*, the involucre, consists of those little leaves which surround the base of the peduncles of umbelliferous plants.

3. *Spatha*, a sheath, is a covering which bursts longitudinally, as in the Snowdrop, but is now called a bract.

4. *Gluma*, a husk, is of a chaffy texture, and is found principally on Grasses. The *husk* gives out an appendage, called *arista* or *awn* which is usually spiral.

5. *Volva*, a wrapper, is a covering of the parts of fructification of some species of the Fungus tribe. It forms a ring upon the stalk, as in the *Agaricus procerus*.

The *Calyx* is an expansion or elongation of the *bark*, which it resembles in colour and consistence; and is considered to be formed from modified leaves. It generally contains air-cells, and its cuticle is studded with little glands. It absorbs carbon, like the leaves, when exposed to the sun, and gives out carbonic acid in the shade, and affords a protection to the other parts of the flower against the severities of the air; it also elaborates juices for the supply of the flower and fruit.

Pedicle and Peduncle.

The peduncle, or flower-stalk, is a ramification of the stem which bears the flowers, but not the leaves; its subdivisions are called pedicles, each of which supports a single flower. These parts are, in many cases, so extremely short, that the flowers are on that account called sessile.

Peduncles are generally round in shape, but by pressure become flattened and angular. They often become enlarged in their extremity, when they give insertion to a collection of sessile flowers, and to this enlarged part the term Clinanthium is applied.

Both pedicles and peduncles are often united to the plant by articulations.

Receptacle.

The *receptacle* is that portion of the vegetable which serves as a basis of insertion to the parts of fructification; or it may be considered an expansion of the pedicle which producés the stamens, petals, nectaries, and any other lamellated formations. It has obtained various names from different authors, being called *torus*, *thalamus*, or *discus*.

The *spadix* is considered as a form of receptacle; it is covered and surrounded by a membranous envelope, called *spatha*, and serves as a peduncle to a considerable number of flowers.

Floral Appendages.

The parts called floral appendages are the proper *nectaries*, the *spur*, *crown*, and *scales*, or *bracts*. All these were formerly called nectaries indiscriminately, till further discoveries pointed out the difference between them.

Nectaries are those glandular bodies which are found situated on the receptacle, germen, or corolla, and secrete particular juices resembling honey.

Calcar, the spur, is a horn-shaped elongation of the floral integuments, which is generally extended by the side of the pedicle.

Corona vel *scyphus*, the crown, is a cup-like portion, resembling the true corolla, as is seen in the centre of the *Narcissus*.

A variety of them is found in *Hellebore*, *Passion flower* and *Mesua*.

Squama, a scale, now named a *bract*, includes any other small leafy appendage of a flower not entering under the denomination of those already mentioned.

Fruit.

The fruit consists of the union of several perfect mature germens, and is the sole object and result of fecundation; it is defined by others as the pistil in a state of maturation. The fruit is composed of two parts, the *pericarp* and the *seed*.

The pericarp is divided into three portions: the external one called *epicarp*, the inner one *endocarp*, and the one between them named *sarcocarp*. In many instances they are distinct and easily separated, but in others intimately blended together.

The pericarp exists in all seeds, although, from its extreme thinness and close adhesion, it occasionally appears to be entirely wanting. The most elevated point of the pericarp generally presents an indication of the remains of the style or stigma, and to this part the term *apex* is applied. The *base* is the spot where it is attached to the pedicle or peduncle, and its axis is represented either by a central pillar, or, in some cases, only by an imaginary line drawn from the base to the apex.

The *epicarp*, which is analogous to an epidermis, is said to correspond with the under surface of a leaf.

The *sarcocarp*, or *mesocarp*, is the parenchymatous portion, and in it all the vessels of the fruit are concentrated.

The *endocarp* is considered as formed by the upper surface of a metamorphosed leaf. It is generally thin and membranous; sometimes it appears to be thickened externally by a portion of the sarcocarp. When this part of the sarcocarp becomes hard and woody, it encloses the seed, and forms what is known as a nut.

The cavity of the pericarp may be single, or divided into numerous separate cells; in the former case it is called one-celled, or unilocular; in the latter, many-celled, in accordance with the number of the partial cavities.

The cells of the pericarp are separated by vertical membranous layers, or plates, called *dissepiments*.

The part where the pericarp unites with the seed is called the *umbilicus*, or *hilum*, and this is considered as the precise boundary between the seed and the pericarp.

The seeds are attached to the inside of the pericarp by a certain fleshy portion, various in form and size, named *trophosperm*, or *placenta*, which traverses the endocarp to receive its vessels from the sarcocarp, or parenchymatous substance. The placenta sometimes gives out several elongations, like pedicles, each supporting a seed, and to these little bodies we apply the term *podosperm*.

When the *trophosperm*, or *podosperm*, extends beyond the hilum of the seed, so as to cover a portion of it, the extended portion is called *arillus*, a familiar illustration of which is found in the mace surrounding the nutmeg.

As the seeds are enclosed in the pericarp, it is a necessary consequence, at the period of their maturity, that the pericarp should open in some particular manner, to allow their exit. The natural act of opening in the pericarp is called *dehiscence*. Pericarps which do not open spontaneously are called *indehiscent*. The separate parts of a dehiscent pericarp are called valves, which vary greatly in number in different plants. The line indicating the point of their separation is named a *suture*.

There are little bodies attached to some pericarps, which may be called appendages, and are very varied in their appearance. Thus, in the pear and apple, it is surmounted by the teeth of the calyx. In some plants it is crowned by a silken feathery substance, called *pappus*, which may also be esteemed a calyx. This pappus is of great use in botanical classification, as it affords excellent distinctive characters. Its use is that of assisting, by its lightness, in the conveyance of the seed to distant parts by the agency of the wind.

Another form of appendage is that of membranous expansions, like wings, as in the elm and maple. The number of these also gives the terms *dipterus*, *tripterus*, &c. In some cases the pericarp is covered with long, stiff hairs, or with thorns, as on the *Chesnut*, and *Thorn-apple*.

The Seed.

The seed is contained in the pericarp, and encloses the rudiment of a new vegetable. There are no seeds which are naked, that is, not covered by a pericarp, although the latter is sometimes so extremely thin and adherent as not to allow of distinction or separation.

Every seed is formed by a fecundated ovulum. The character of a seed is this: it contains an organized body, which, under favorable circumstances, is developed, and forms an individual precisely similar to the one from which it derived its existence.

The seed is composed of two parts, the *Kernel* and its covering, the *Episperm*.

The point where the seed is joined to the pericarp is called the hilum or umbilicus, through which the vessels pass from the trophosperm to the proper integument of the seed.

The centre of the hilum represents the *base* of the seed; its apex is the point diametrically opposite.

Seeds differ considerably in respect to their direction relatively to the axis of the pericarp. Thus they are said to be *erect, inverted, ascending, suspended,* &c.

The episperm surrounding the seed is generally simple and uniform; it is sometimes of some thickness, presenting a fleshy appearance, and admitting of a separation into two layers; the outer one called *testa*, the inner one *tegmen;* these may be easily seen in the seed of the Ricinus.

The *Hilum* is always situated on the episperm. It is generally small, but in some cases of considerable size. The whitest portion seen on the Chestnut is all hilum. Towards the centre or sides of the hilum is seen a very small aperture, termed by M. Jussieu *omphalode*, by others *micropyle;* it is considered as affording passage for the vessels from the trophosperm to the episperm. When the plexus of vessels runs along the episperm for some little distance, it forms a prominent part, called the *Raphe*, or *Vasiduct;* the inner point of its termination is called the *Chalaza*, or internal umbilicus.

The *Kernel* comprises the whole of the seed contained within the episperm. It is sometimes formed exclusively by the embryo, but in other cases there is superadded the *Endosperm*, called by different authors *Perisperm*, or *Albumen*.

The *endosperm* is a mass of cellular tissue enclosing fæcula of starch or mucilage. It is either hard like horn, or fleshy and soft, and, during germination, undergoes a gradual decrease. It surrounds the embryo, with which there is no vascular communication; but during germination it affords a great supply of nourishment. Its colour is generally white, but its substance is very variable. It is dry and farinaceous in Corn, oily and fleshy in the seeds of the Ricinus, and of a horny consistence in the Coffee. Its presence or absence is of some importance in tracing distinctions of the genera.

The Embryo.

The *embryo*, or rudiment of a new plant, is enclosed within the episperm, and may be invested by endosperm, as in the Ricinus, or unaccompanied by it, as in the Bean.

The parts forming the embryo are the *Radicle, Cotyledons, Plumula,* and *Collum*, or neck.

The *rootlet*, or radicle, is one of the extremities of the embryo, which, after germination, becomes the root, or gives rise to its formation. It is not always recognised with facility, but is very evident as soon as germination commences. It has an invariable tendency to seek the centre of the earth, whatever be the obstacles opposed to it. In some plants, by its simple elongation, it is transformed into the root; this is observed in most of the Dicotyledones. Plants having the radicle external and uncovered, are called *exorhizæ*. In other plants, on the contrary, the rootlet is covered and hidden by peculiar envelope, which bursts at the period of germination; this envelope is called a *coleorhiza*, and the plants possessing it *endorhizæ*, which include most of the monocotyledones. In some rare instances the rootlet appears to be intimately united with the endosperm; plants with this arrangement are called *synorhizæ*.

The *cotyledonous* substance may be single and undivided, and in such a case is composed of one cotyledon, giving to plants the character *monocotyledones*; plants possessing two are called *dicotyledones*, those with more than two are named *polycotyledones*. The cotyledons appear to be intended to assist in the development of the young plant, by supplying it with materials fit for its nutrition. They are thick and fleshy in plants wanting the albumen, but in those possessing it they are thin and foliacious. At the time of germination some cotyledons remain concealed in the ground, and are called *hypogeal*. When they emerge from it they are said to be *epigeal*, and then form the (folia seminalia) seminal leaves.

The *plumelet* (gemmule of Richard) is the little body which springs upwards from between the cotyledons, or from the cotyledonous centre, if it be single. It may be considered as the first bud of the plant, the first leaves of which, when expanded, are called *primordial*.

The *collum*, or neck, is the point of union between the radicle and plumelet.

The embryos of monocotyledons and dicotyledons differ very considerably in appearance. The *dicotyledonous embryo* presents the following characters: the radicle is cylindrical or conical, naked, and projecting, and forms by germination the root of the plant. Its two cotyledons are on an equal level on the little stem, and are generally very thick, if the albumen be scanty or deficient. The plumelet is enclosed between the cotyledons, which conceal it entirely or in great part.

In the *monocotyledonous embryo*, the cotyledon, before germination, was perfectly indivisible, presenting neither cleft nor incision. The separate parts of these embryos are not easily distinguished in all cases, for they are sometimes so united and blended together as to appear one homogeneous mass. Hence their organization is less known than that of vegetables, which have two cotyledons. The radicular body occupies one of its extremities; it is rounded, but slightly projecting, forming a kind of mammillary protuberance; however, it is very large in some instances, and forms the largest portion of the embryo, as in most of the Gramina.

The rootlet is inclosed in a *coleorhiza,* which it bursts at the period of germination. It is sometimes composed of several fibres, each of which, in some instances, pierces the coleorhiza separately.

The cotyledonous substance is single, but its form is extremely variable. It is always lateral, in relation to the embryo. The plumelet is generally enclosed in the centre of the cotyledon, which surrounds it on all sides; it is composed of small leaves encased the one within the other; the external portion of which is named by Mirbel *Pileolus.* The plumelet is sometimes covered, like the root, by a substance which it bursts, called a *Coleoptile.*

Classification of Fruits.

The seed-vessels of separate plants differ, not only in form, but likewise in the relative proportion and arrangement of the individual parts.

The varieties of fruits are classified in many different ways by botanists, and have each received a separate name. A simple and general division of them may be made into *simple, multiple,* and *compound.*

The *simple* fruit is produced from a single pistil, contained in a flower, as in the *cherry* and *peach.*

The *multiple* fruit is produced by several pistils, contained within one flower, as in the *strawberry* and *raspberry.*

The *compound* fruit results from the union of a number of pistils, sometimes consolidated together, but all arising from distinct flowers, which were very closely approximated, as in the *mulberry.*

They are divided into *dry* and *fleshy,* on account of the character of their pericarp.

The most simple outline of arrangement of them is the following:

$$\text{Class I. Simple fruits,}\ \begin{cases}\text{Dry,} \begin{cases}\text{Indehiscent.}\\ \text{Dehiscent.}\end{cases}\\ \text{Fleshy, Indehiscent.}\end{cases}$$

Class II. Multiple.
Class III. Compound.

Simple, Dry, and Indehiscent Fruits.

Fruits of this class are generally oligosperm; that is to say, they contain few seeds. Their pericarp is generally thin, and sometimes so closely united with the proper integuments of the seeds as to appear as if wanting, and giving rise to the error of seeds ever being naked, or without a pericarp.

1. The *caryopsis* is one-seeded and indehiscent. The pericarp is so thin, and so intimately blended with the seed-coats as not to admit of separation. Its form varies considerably. We have examples of it in Wheat, Barley, Indian corn, &c.

2. The *akenium* is one-seeded, indehiscent, with its pericarp distinct from the seed, as in the *Synantheræ*, the *Sunflower*, &c.

It has often appendagesat tached to it, as the *Pappus*, &c.

3. The *polakenium* is a single fruit, which, when ripe, is separated into two or more cells, each of which may be regarded as an akenium. Such are found on the *Umbelliferæ*.

4. The *samara* is coriaceous, membranous, and flattened, having generally two cells, which send out lateral elongations, or enlarged appendages, called *alæ*, as in the Maple and Elm.

5. *Glands;* a gland, or nut, is generally one-celled, and indehiscent; its pericarp is closely united with the seed, and it is, in great part, surrounded by a woody or leafy involucre, called a cupule, as in the nut or acorn.

Simple, Dry, and Dehiscent Fruits.

These are generally many-seeded; the number of their valves and cells is very variable. They are, in general terms, designated capsular.

1. *Folliculus*, a follicle, is generally membranous, one-celled, and one-valved, opening by a longitudinal suture, to which is attached the trophosperm, generally supporting the seeds on one side of the suture only.

2. *Siliqua*, a pod, is elongated, bivalve, with the seeds attached to two sutural trophosperms. It is sometimes separated into two cells, by a partial partition parallel with the valves. This partition is formed by an elongation of the trophosperms, as in the Cruciferæ.

3. *Silicula*, a silicle, differs very little from the siliqua. It is shorter in proportion to its breadth, and has fewer seeds. It likewise belongs to the Cruciferæ.

4. *Legumen*, a legume, is dry, and bivalve. Its seeds are attached to a single trophosperm, which follows the direction of one of the sutures only, as in the Leguminosæ.

There is great variety in the legume; it is naturally one-celled, but there is occasionally a partial septum, dividing it into two or more cells, as in the Astragalus. In the *Cassia* it is separated into numerous cells by transverse septa, and has been named a *lomentum.*

Sometimes it seems as if formed by separate portions, articulated together, as in the Lomentaceæ. It is occasionally swelled out, as if inflated, and has thin transparent parietes, as in the *Colutea.* The seeds vary considerably in number. There are some legumes which contain but one.

5. The *pyxidium* is capsular, generally globular, and opening by a transverse fissure into two hemispherical valves, as in the *Hyosciamus.*

6. The *coccus*, or elaterium, has generally its sides or divisions raised, and elastic; it bursts longitudinally, and is then divided into so many cells. Hence the terms *bicoccus*, *tricoccus.*

7. *Capsula*, a capsule, may be considered to be any dry dehiscent fruit not comprised under the previous heads. Hence great variety in them may be anticipated. Thus, there are some which open by pores in their upper part, as in the Poppies; others open by their base. Many are dehiscent only at their summit, which, before ripening, was closed by little teeth closely arranged.

Fleshy Fruits.

Fleshy fruits are indehiscent; they are thick and pulpy, and the number of their seeds is very variable.

1. *Drupa*, a drupe, is a fleshy fruit, enclosing a stone, which is formed by the hardening of the endocarp and portion of the sarcocarp, as in the peach, cherry, &c.

2. *Nux*, a nut, differs from the drupe only in having a thinner pericarp, as in the almond and walnut.

3. *Pomum*, a pome (melonide of Richard), is a fleshy fruit arising from numerous parietal ovaries, united and consolidated with the calyx, as in the apple and pear.

The endocarp lining each cell of a pome is said to be cartilaginous or bony. It is cartilaginous in the apple, and bony in the blackthorn and medlar.

The pome belongs exclusively to the Rosaceæ, all of which bear either this precise form of fruit, or one closely resembling it.

4. *Pepo*, a gourd, is a fleshy fruit, with generally three cells distributed in the pulp, each containing seed, which are firmly united with its inner coat, so as to be separated with the greatest difficulty, as in the melon.

5. The *hesperidium* is a fleshy fruit, with a thick envelope, divided internally into many cells by membranous septa, which may be separated without laceration, as in the lemon, &c.

6. *Bacca*, a berry, is a term applied to all fleshy fruits deprived of a stone, which do not enter under the above-named species, as grapes, gooseberries, &c.; and is described by Dr. Lindley as a succulent fruit, the seeds of which lose their adhesion when ripe, and lie loose in the pulp.

Multiple Fruits.

Multiple fruits are produced by the union of numerous pistils contained in one flower, and generally obtain the name of Syncarpium.

The raspberry and strawberry are formed by a number of little drupes (the sarcocarp of which is rather thin, but very evident in the strawberry), united together upon a fleshy gynophore.

Compound Fruits.

Compound fruits are formed by the union of several separate fruits closely approximated and united together, but all produced by separate flowers.

1. *Conus* vel *strobilus*, the cone or strobile, is composed of a number of membranous capsules, situated under imbricated scales, which were as bracts to the flower, inserted upon a common axis, and assuming the form of a cone.

2. *Syconium* is the name applied by Mirbel to the fruit of the Fig tree, and Contrajerva. It is formed by a monophyllous involucre which is fleshy internally, either flatted or oval and closed, containing numerous drupes, each the product of a separate flower.

Buds.

Buds are protuberances which shoot forth from various parts of a plant, as the stem and branches, and contain the rudiments of leaves, flowers, and their supports. The arrangement of the leaves in buds is called vernation, that of the flowers æstivation, and from the protection they afford to the embryo in cold weather, the buds themselves are called hybernacles. Buds are of three kinds, *leaf buds*, *flower buds*, and *mixed* or *compound*, that is, containing rudiments both of leaves and flowers.

Flower buds enclose a flower without leaves, and are generally round and conical. Leaf buds contain leaves only, and are smaller and more pointed, as may be seen on the Daphne mezereum.

The mixed or compound buds contain both flowers and leaves, as on the Lilac.

Buds generally shoot out at the angle formed by the leaves and the stem, called the axilla, and contain a process, or elongation of the *pith.*

Nature has covered them with various substances for their protection, such as scales, and woolly or glutinous substances, which are more observable in cold climates, and wanting altogether on plants in hot countries.

The bud when developed is called a shoot.

All shoots of vegetables have a tendency to turn towards the light, for if they are placed in a dark room where there is a single aperture, they will generally grow towards it. This fact has been made the subject of some pretty and ingenious experiments.

Bulbs, as *Onions,* have for a long time been confounded with *Roots,* and are still considered so by some botanists, though they are, in point of fact, nothing but buds, their scales being only rudimentary leaves.

Cauline bulbs differ from common bulbs in being produced on different parts of a plant, as at the junction of the leaves, and the bifurcation of the branches; vegetables producing them are called viviparous. Bulbs differ from bulbs only in the property of throwing out roots into the earth, and in deriving the nourishment in a different manner. They for the most part belong to monocotyledonous plants.

Tuberous Roots, or Tubercles, are pulpy fleshy receptacles, which throw out shoots and roots, but are now described as expansions of the internodial spaces of an underground stem; they differ from bulbs in producing buds at different parts of their surface; a familiar example may be found in the potato.

CRYPTOGAMOUS PLANTS.

Cryptogamous plants require a separate consideration; for the description of the various parts of Phanerogamous plants affords little assistance in distinguishing and examining the twenty-fourth class of the Sexual System of Linnæus.

Those plants may be divided into five distinct orders; viz., *Filices, Ferns; Musci, Mosses; Hepaticæ, Liverworts; Algæ, Flags; Fungi, Funguses.*

Ferns.

Their root is fibrous, and proceeds from a *tuber*, or knotted portion, from which also the fronds arise. The tuber is protected by a covering of soft scales.

The plant itself consists of a stalk, and its leafy expansion called frond, which admits of great variety in its shape and size, growing from the length of an inch to several feet.

The stem varies as to its surface, being polished, scaly, or channeled; and its structure much resembles that of annual stalks in general. Ferns may be propagated by seeds or sporules. Their fructification is only manifest in those rounded or spotted little granular excrescences which are observed on the under surface of the leaves or frond. They are called thecæ, and contain little reproductive bodies called *sporules*.

Mosses.

Mosses are composed of elongated cellular tissue, no spiral vessels being admitted as existing in them. The Mosses have fibrous roots, which possess great power of multiplying themselves; they are produced, in some instances, from the stem, in others from any part of the leaf, and are generally terminated by a spongy substance. The Mosses have also stems and leaves, which are always sessile; the leaves are thickly set with pores, which supply them amply with moisture and render them very tenacious of life, for they will revive after being apparently dead and dried up.

The parts of fructification are very indistinct.

There are little bodies of various shapes on the stem, which are considered to be *anthers* and *pistils*. Notwithstanding the uncertainty as to this point, the calyptræ or thecæ contain a dust, which has been sown, and known to grow.

Mosses grow best in cold or temperate climates, and derive their chief subsistence from the air.

Liverworts.

These vegetables form a connecting link between Mosses and flags; their structure is the same, for they have no vessels or stomata; they grow on rocks, and are generally attached to the spot by the under surface of the *frond.* Their roots are less numerous than those of the Mosses, but they are propagated like them by sporules, which are enclosed in membranous cases called *scutellæ.*

Flags.

The Algæ are plants in which the root, stem, and leaves seem blended together; some Lichens form exceptions, in throwing out little roots. Algæ have been properly arranged in six divisions, differing from each other in form, properties, and habit; they are *Lichens, Byssi, Confervæ, Ulvæ, Fuci,* and *Tremellæ.*

1. *Lichenes,* Lichens, are a numerous tribe; they grow in all climates and in most situations, and in various instances possess some of the chemical properties of the body on which they grow. They produce sporules, by which they are propagated.
2. *Byssi* exist in the forms of the most delicate downy substance, which is found on old wood, in moist situations.
3. *Confervæ* are all aquatic, and grow in the form of green filaments, branching in every direction; their structure is too indistinct to lead to any decisive conclusion as to their fructification or organization.
4. *Ulvæ* are aquatic, of various forms, but always gelatinous; their soft nature precludes a possibility of examining them satisfactorily.
5. *Fuci* comprehend the various vegetables commonly called Sea-weeds; they vary greatly in their form, substance, and organization.
6. *Tremellæ* appear on rotten wood, grass, and in moist weather, like masses of jelly; their organization has been imperfectly ascertained.

Fungi.

Fungi are, after the Tremellæ, the lowest order of the vegetable creation.

They are of a fleshy texture, and their most common form is that of a thick frond, having its under surface furnished with laminæ, like the gills of a fish, as in the *Agaricus;* or with deep perforations like a honeycomb, as in the *Boletus;* or in that of a ball, as the *Lycoperdon.*

The parts of a Fungus are—

The *root,* which generally is in the form of white fibres.

The *stem, stipes,* is common to several species, and is surmounted by the cap. Some are destitute of stems altogether.

The *cap*, *pileus*, is only found on those Fungi which possess the stipes.

The *veil*, *calyptra*, is a membranous expansion, which connects the external margin of the circumference of the cap to the *stipes*. At the mature state of the plant it bursts.

Volva, the wrapper, encloses the entire parts of the frond, in some species, at an early period of their growth.

Fungi are supposed to be propagated by sporules, enclosed in little cases called *hymenia*.

Germination.

By germination is understood the evolution of a plant from a perfect seed, and its duration extends to the period when the cotyledons are absorbed or dried up. If a seed be placed in the ground, or in a situation and circumstances favorable to its vegetation, the embryo swells, cracks, and separates its envelope, and becomes *plantula*, a young plant. The developed embryo consists of the *blastema* and *cotyledons*. The blastema is divided into the collum, plumula, and radicula. The cotyledons are the parts first observed when seeds begin to vegetate; their presence or absence is the most important question connected with them. Plants that are formed without apparent cotyledons are called *acotyledonous;* those with one cotyledon, *monocotyledonous;* those with two, *dicotyledonous;* and those with three or more, *polycotyledonous*.

In order that germination may take place, it is requisite that a seed contain all the essential parts, and possess vitality. Some seeds perish from being too long kept without sowing, dying at the end of two years, whilst there are others that may be kept in a similar manner for many years, even to the extent of centuries.

The external agents of *germination* are water, heat, and air.

If a *seed* be placed in favorable circumstances, the moisture penetrates internally through the *hilum*, swells out the young plant, moistens the seed-coats, and facilitates the rupture of the envelope, by rendering it softer.

Heat acts as a stimulant, and must not be applied either in too great or diminished a degree. Air is so necessary to *germination* that seeds will not grow in an exhausted receiver; and no gas is so congenial as the mixed proportions of the gases which compose the air of the atmosphere.

The chemical changes which take place during *germination* next require consideration. The *oxygen* of the air insinuates itself with the moisture into the embryo; a quantity of water penetrating, gives rise to saccharine fermentation, which is changed to spirituous fermentation by means of the air. The elementary component parts of the farinaceous *perisperm*, or *albumen*, are *oxygen*, *hydrogen*, and *carbon;* and the same principles are contained in the fæcula of all vegetables. The access of *oxygen* destroys the equilibrium, and combines with the *carbon:* the *oxygen* of the fæcula thus predominating, a new arrangement of the elements takes place, and the farinaceous *perisperm* is changed to a state of soluble sugar.

The saccharine matter enclosed in the cotyledons escapes from them by means of vessels which convey it to the young plant, which is stimulated and awakened, as it were into a new life. All these phenomena indicate a spirituous fermentation, for a seed will not putrefy, unless an excess of water arrests its evolution. At this period of vegetable growth, the embryo evolves the *plantula*, or young plant, consisting of the *ascending caudex*, or *plumelet*, and the *descending caudex*, or *radicle*.

The cotyledons continue to supply the embryo with nourishment until the little root acquires sufficient vigour for that purpose. The root soon throws out ramifications, which are terminated by spongy bodies, to absorb the fluids from the earth, or from substances capable of supplying them with nourishment. The cotyledons being exhausted, become useless, dry up, and fall off.

At the same time that the juices are being absorbed by the roots, another change is going on in the leaves. The spirituous fermentation stops, on account of the carbonic acid gas, and the water being decomposed, and no longer affording saccharine matter, the carbon, which had hitherto been rejected, combines with the elements of the water, and the substances mixed with it. This new combination forms woody, oily, and resinous substances, and the proper juices of plants. The phenomena which commence at this period continue till the death of the vegetable.

Light is so essential to plants, that to it they owe the solidity of their structure, their colour, and the peculiar condition of the proper juices.

Every plant which grows in the dark will be deprived of these qualities, whilst the seed, on the contrary, would be injured by exposure.

All seeds grow in accordance with the physical laws just described, but vary in the mode of evolution; some, for instance, begin to grow before they are separated from the parent plant, thus deriving the necessary moisture from a very different source.

On Vegetable Life.

Vegetable life consists in the power which resists, for a longer or shorter space of time, the laws of chemical affinity and gravitation. The causes are totally unknown.

The vital phenomena consist in irritability, nutrition, and propagation.

Nutrition is that property by means of which plants develop themselves, increase, and acquire their ultimate dimensions.

The phenomena connected with nutrition are irritability, absorption, circulation, and excretion.

Plants are sensible of the action of stimulants, for hæmorrhage may be stopped in the same manner as that adopted, for a similar occurrence, in an animal. Contraction is the first cause of the spontaneous motion in plants, excited either by external or internal agents. There are various ways in which the irritability of plants is manifested.

Many plants afford a phenomenon of irritability to which Linnæus has given the appellation of sleep. At the approach of night they alter their direction, and resume their daily position in the morning.

The Sensitive Plant has been more subject to observation than any other, on account of the singularity of its movements. If it be touched or shaken, if excessive heat or cold be applied, its leaves fold up, and the petiole is lowered, and hangs down upon the stem.

The *Dionæa muscipula* offers another species of irritability still more singular: its leaves are composed of two lobes, united in the middle by a fleshy centre; if an insect touches these lobes, they approach each other, seize the poor sufferer, and pierce him to death, or starve him.

The extremity of the leaves of the *Nepenthes distillatoria* is furnished with a vase and its lid; this vase becomes filled with a secreted liquid, and the lid opens and shuts according to the state of the weather.

Nutrition.

Vegetables, on analysis, are found to consist of *oxygen*, *hydrogen*, *carbon*, and *azote*, besides a multiplicity of compound salts and metallic oxides, all of which are supplied by the earth and air.

Water holds in solution a certain quantity of salts, and vegetable and animal matter; the roots absorb these substances with the water, and they are conveyed by the sap to the organic tissue, where a portion is assimilated by the plant, and the other portion passes off by transpiration. The air supplies a quantity of oxygen and azote, and a great abundance of carbonic acid gas.

The oxygen of the atmosphere also unites with the carbon of the plant, and forms carbonic acid gas, which is decomposed by light, and the carbon becomes fixed in the plant.

Plants absorb fluids by a power called suction, which is considered to be prodigious, being more considerable than the pressure of the atmosphere.

The fluids absorbed by the roots or leaves are conveyed to the entire vegetable by the large vessels of the wood, and especially by the soft layers of the alburnum. The explanation most generally received is the following:

The fluids pass upwards through the alburnum and woody layers. They descend through the liber or cortex, and are dispersed horizontally by the medullary rays. When vegetation commences, the sap is accumulated in the youngest parts of the wood or branches, where it undergoes a certain process, and forms what is called cambium.

The circulation of the sap is assisted by caloric, which is a stimulant, by light, electricity, the rarefaction and condensation of air in the vessels, and by capillary attraction.

It was for some time imagined that the sap had two kinds of motion—an ascending one in spring, and a descending one in autumn; but this opinion is now abandoned. Some botanists imagined that the sap flowed upwards during the day, and downwards into the roots in the evening; this theory likewise is but weakly supported. There seems to be a constant tendency in the sap to rise, and diffuse itself in all the vacant spaces.

There are three modes of excretion in plants, viz., exudation, respiration, and transpiration.

The exudations are juices of various consistence, such as resins, oils, manna, sugar, wax, &c.; the viscid matter which escapes from the extremities of the hairs on Rose trees; and the liquids which ooze from glands, pores, and nectaries.

Respiration, which includes also absorption, is attended with the separation of oxygen and carbonic acid gas; oxygen is disengaged during the day, but carbonic acid in the dark or at night.

The transpiratory fluid, which may be considered as excrementitious, is composed of water reduced to vapour, mixed with other principles, capable of solution and evaporation; such is the fluid that is found on *Cabbage* leaves in the morning.

The fluid which escapes from some plants is so great, that a *Sunflower*, of equal size, and in an equal space of time, perspires seventeen times more than a man.

ARTIFICIAL OR SEXUAL ARRANGEMENTS OF PLANTS,

BY LINNÆUS.

According to this system, plants are distinguished by the number, situation, relative size, and connexion of the stamens.

They are arranged in twenty-four classes, which are designated by terms of Greek derivation.

The orders are known by the number of pistils, the form of the fruit, or florets, and by natural divisions.

The first eleven classes may be distinguished by the number of stamens alone, the flowers being all perfect.

Class 1. MONANDRIA, has one stamen only. There are but few plants in this class.

Class 2. DIANDRIA, has two stamens.

Class 3. TRIANDRIA. This class has three stamens; the species of it are exceedingly numerous, including the natural order, *Graminaceæ*.

Lolium temulentum, and *Secale cereale*, are the only plants of this class which are poisonous.

Class 4. TETRANDRIA. The four stamens of this class are of equal length, which circumstance separates it from class Didynamia, which has four unequal stamens, two being long, and two short.

Class 5. PENTANDRIA. This class has five stamens. Plants in the first order, which have a berry for their fruit, are for the most part poisonous. Plants of the second order, *Digynia*, if growing on a dry soil, are aromatic, whereas those growing in wet places, or in the water, are more or less poisonous.

Class 6. HEXANDRIA. In this class there are six stamens; all of equal length and the petals are not limited to four, as in *Tetradynamia*. Many plants of this class are supplied with bulbs, improperly called bulbous roots.

Class 7. HEPTANDRIA, has seven stamens.

Class 8. OCTANDRIA, has eight stamens.

Class 9. ENNEANDRIA, has nine stamens.

Class 10. DECANDRIA, has ten stamens.

Class 11. DODECANDRIA, has from twelve to nineteen stamens.

Class 12. ICOSANDRIA, has twenty stamens or more, which are inserted into the calyx or corolla.

This class affords our principal fruits, as apples, pears, plums, &c. Plants producing fruit, and the stamens of which grow out of the calyx, are never poisonous. The stamens are called *epigynous* or *perigynous*.

Class 13. POLYANDRIA. This class is known by having numerous stamens, which grow out of the receptacle, and are hypogynous.

Most of the medicinal plants of this class are poisonous. As the number of stamens do not form a sufficient distinction between the classes Icosandria and Polyandria, the following rule may be attended to. If, when the calyx and petals are removed, the stamens remain attached to the receptacle, the plant may be determined as belonging to class 13, Polyandria; but if the stamens are removed by detaching the petals or calyx, the plant may then be referred to Class 12, Icosandria.

Class 14. Didynamia. This class has four stamens, of which two are long, and two short. It comprises the ringent and personate flowers.

Class 15. Tetradynamia. This class is known by having six stamens, two of which are short, and four long. The flowers of plants of this class are for the most part cruciform; they are antiscorbutic, and contain more nitrogen than any other class.

(Classes 16, 17, 18, 19, and 20 are known by the particular mode of union of the stamens, and not by their number.)

Class 16. Monadelphia. The stamens are all united at their bases into one tube. It includes the natural order *Columniferæ* or *Malvacæ*.

Class 17. Diadelphia. The stamens are arranged in two bundles, which are sometimes united at their bases. The *Papilionaceæ* are the most numerons of this class.

Class 18. Polyadelphia. The stamens are arranged in more than two bundles, as in the *Hypericum*.

Class 19. Syngenesia, contains compound flowers, which class consists of a congeries of small flowers, of tubular or ligulate florets, inserted upon a common receptacle, and surrounded by a common calyx. The stamens in each floret are five in number, and are united so as to form a tube round the pistil.

Class 20. Gynandria. In this class the stamens are nited with the style or germen.

(Classes 21, 22, and 23 are known by the stamens and pistils being found on separate flowers, or on separate plants.)

Class 21. Monœcia, has the stamens in one flower, and the pistils in another, on the same plant.

Class 22. Diœcia, has the stamens and pistils on separate flowers, and on separate plants.

Class 23. Polygamia, has three kinds of flowers, some with stamens only, others with pistils, and others with both; sometimes on the same plant, and sometimes on different ones.

Class 24. Cryptogamia, has the stamens and pistils indistinct, and the parts of fructification generally are difficult to distinguish and decide upon.

The Orders.

The orders are generally known by the number of the pistils, but these are inadequate to form sufficient distinction in every case. The situation of the seeds, and the form of the seed-vessel, constitute characters of more importance. The orders of the first thirteen classes are known from the number of the pistils alone, and are the following:

Monogynia	has	one pistil.
Digynia	,,	two pistils.
Trigynia	,,	three pistils.
Tetragynia	,,	four pistils.
Pentagynia	,,	five pistils.
Hexagynia	,,	six pistils.
Heptagynia	,,	seven pistils.
Octagynia	,,	eight pistils.
Enneagynia	,,	nine pistils.
Decagynia	,,	ten pistils.
Dodecagynia	,,	twelve pistils.
Polygynia	,,	numerous pistils.

The Orders of the Fourteenth Class are distinguished by their fruit. Thus:

Order 1. *Gymnospermia*, has its naked seeds, which are usually situated at the bottom of the calyx. Plants of this order are for the most part wholesome.

Order 2. *Angiospermia*, has the seeds in a seed-vessel. The plants of this order are sometimes poisonous.

The Orders of the Fifteenth Class are distinguished by the shape of the seed vessel:

Order 1. *Siliculosa*, has fruit of the shape of a rounded pod, as in the *Radish*.

Order 2. *Siliquosa*, bears a seed-vessel of the form of a long pod, or *siliqua*.

The Orders of Classes 16, 17, and 18 are distinguished in the same manner as those of the first thirteen.

The Orders of the Nineteenth Class are known by the arrangement of the florets.

Order 1. *Polygamia æqualis*, has the florets all perfect and similar, containing both stamens and pistils.

Order 2. *Polygamia superflua*, has the florets of the disk perfect. Those of the circumference contain a pistil only.

Order 3. *Polygamia frustanea*, has the florets of the disk perfect, and those of the circumference barren.

Order 4. *Polygamia necessaria*, has the florets of the disk with stamens only, and those of the circumference with pistils only.

Order 5. *Polygamia segregata*, bears several flowers with a separate calyx, all united in one common calyx, as n the *Globe Thistle*.

The Orders of Class 20 are known by the number of the stamens; those of the Twenty-first and Twenty-second Classes, by the stamens, or the arrangements of the filaments.

Class 23 has its Orders distinguished by the arrangement of the flowers on different plants:

Order 1. *Monœcia*, has the two descriptions of flowers on the same plant.

Order 2. *Diœcia*, has the different descriptions of flowers on two separate plants.

Order 3. *Triœcia*, has different flowers on three different plants.

The Orders of Class 24 are natural divisions or families,

1. *Filices*,	Ferns.
2. *Algæ*,	Flags.
3. *Musci*,	Mosses.
4. *Hepaticæ*,	Liverworts.
5. *Fungi*,	Funguses.

A list of the Genera of the Plants enumerated in the London, Edinburgh, and Dublin Pharmacopœias.

Class 1.
MONANDRIA.

Order 1. Monogynia.

Alpinia (*Cardamomum*).
Curcuma.
Zingiber.

Class 2.
DIANDRIA.

Order 1. Monogynia.

Gratiola.
Galipea (*Cusparia*).
Olea.
Rosmarinus.
Salvia.
Veronica.

Order 3. Trigynia.

Piper.

Class 3.
TRIANDRIA.

Order 1. Monogynia.

Crocus.
Iris.
Valeriana.

Order 2. Digynia.

Avena.
Hordeum.
Saccharum.
Secale.
Triticum.

Class 4.
TETRANDRIA.

Order 1. Monogynia.

Dorstenia.
Krameria.
Rubia.

Class 5.
PENTANDRIA.

Order 1. Monogynia.

Anchusa.
Atropa.
Capsicum.
Calicocca (*alias Cephaelis*).
Cinchona.
Convolvulus.
Datura.
Diosma (*Barosma Buchu*).
Erythræa (*olim Chironea*).
Exogonium.
Hyoscyamus.
Menyanthes.
Nicotiana.
Rhamnus.
Solanum.
Spigelia.
Strychnos.
Viola.
Vitis.

Order 2. Digynia.

Anethum.
Angelica.
Carum.
Conium.
Coriandrum.
Cuminum.
Daucus.
Dorema.
Eryngium.
Ferula.
Galbanum.
Gentiana.
Pastinaca.
Pimpinella.
Ulmus.

Order 3. Trigynia.

Rhus.
Sambucus.

Order 3. Pentagynia.

Linum.

Class 6.

HEXANDRIA.

Order 1. Monogynia.

Acorus.
Allium.
Aloe.
Scilla.

Order 3. Trigynia.

Colchicum.
Rumex.

Class 7.

HEPTANDRIA.

Order 1. Monogynia.

Æsculus.

Class 8.

OCTANDRIA.

Order 1. Monogynia.

Amyris.
Daphne.

Order 3. Trigynia.

Polygonum.

Class 9.

ENNEANDRIA.

Order 1. Monogynia.

Laurus.

Order 3. Trigynia.

Rheum.

Class 10.

DECANDRIA.

Order 1. Monogynia.

Arbutus.
Boswellia.

Order 1—continued.

Cassia (*Senna*).
Cathatocarpus (*olim Ca*
Fistula).
Copaifera.
Guaiacum.
Hæmatoxylon.
Myroxylon.
Quassia.
Rhododendron.
Ruta.
Stryax.
Swietenia.
Toluifera.

Order 2. Digynia.

Dianthus.

Order 5. Pentagynia.

Oxalis.

Class 11.

DODECANDRIA.

Order 1. Monogynia.

Asarum.
Canella.
Lythrum.

Order 2. Digynia.

Agrimonia.

Order 3. Trigynia.

Euphorbia.

Class 12.

ICOSANDRIA.

Order 1. Monogynia.

Amygdalus
Caryophyllus (*olim Eugeni*
Myrtus.
Prunus.
Punica.

Order 5. Pentagynia.

Pyrus.

Order 8. Polygynia.

Geum.
Rosa.
Tormentilla.

Class 13.

POLYANDRIA.

Order 1. Monogynia.

Dryobalanops.
Papaver.

Order 3. Trigynia.

Aconitum.
Delphinium.

Order 4. Tetragynia.

Winteria.

Order 6. Polygynia.

Helleborus.

Class 14.

DIDYNAMIA.

Order 1. Gymnospermia.

Hyssopus.
Lavandula.
Marrubium.
Melissa.
Mentha.
Origanum.
Teucrium.

Order 2. Angiospermia.

Digitalis.
Scrophularia.

Class 15.

TETRADYNAMIA.

Order 1. Siliculosa.

Cochlearia.

Order 2. Siliquosa.

Cardamine.
Sinapis.

Class 16.

MONADELPHIA.

Order 1. Triandria.

Tamarindus.

Order 8. Polyandria.

Malva.
Althæa.

Class 17.

DIADELPHIA.

Order 3. Octandria.

Polygala.

Order 4. Decandria.

Astragalus.
Cytisus.
Mucuna (*olim Dolichos*).
Geoffræa.
Liquiritia (*olim Glycyrrhiza*).
Pterocarpus.

Class 18.

POLYADELPHIA.

Order 3. Icosandria.

Citrus.
Melaleuca.

Class 19.

SYNGENESIA.

Order 1. Polygamia Æqualis.

Arctium.
Lactuca.
Leontodon.

Ord. 2. Polygamia Superflua.

Anthemis.
Arnica.
Artemisia.
Inula.
Solidago.
Tanacetum.
Tussilago.

Ord. 3. Polygamia Frustranea.

Centaurea.

Class 20.

GYNANDRIA.

Order 4. Hexandria.

Aristolochia.

Class 21.

MONŒCIA.

Order 1. Monandria.

Euphorbia.

Order 4. Tetrandria.

Morus.

Order 7. Polyandria.

Arum.
Quercus.

Order 8. Monadelphia.

Croton.
Cucumis.
Momordica.
Pinus.
Ricinus.

Class 22.

DIŒCIA.

Order 9. Diandria.

Salix.

Order 5. Pentandria.

Humulus.
Pistacia.

Order 6. Hexandria.

Smilax.

Order 10. Dodecandria.

Menispermum (*Calumba*).

Order 13. Monadelphia.

Juniperus.
Myristica.

Class 23.

POLYGAMIA.

Order 1. Monœcia.

Acacia.
Stalagmitis.
Veratrum.

Order 2. Diœcia.

Ficus.
Fraxinus.

Class 24.

CRYPTOGAMIA.

Order 1. Filices.

Aspidium.

Order 3. Algæ.

Fucus.

Order 5. Lichenes.

Cetraria Islandica (o
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Roccella.

Order 6. Fungi.

Boletus.

THE END.

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187. Anxietas, medico sensu, oritur imprimis a causa quacunque sanguinis motum, per cor vasaque magna prope cor pulmonemque, turbante vel impediente. Hinc vitia cordis ejusque vasorum multiplicia, amplificationem, constrictionem, conversionem in os, polypum, palpitationem, syncopen, inflammationem, debilitatem, et ideo nonnullos animi affectus comitatur.

187. Anxiety, in a medical sense, arises especially from any cause disturbing or impeding the motion of the blood through the heart, and the large vessels near the heart and lungs. Hence it accompanies the numerous disorders of the heart and its vessels; such as enlargement, narrowing, ossification, polypus, palpitation, syncope, inflammation, debility, and, consequently, some affections of the mind.

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XIV. Si vero tertiana, quæ ex toto intermittit, aut quartana est; mediis diebus, et ambulationibus uti oportet, aliisque exercitationibus, et unctionibus. Quidam ex antiquioribus medicis Cleophantus in hoc genere morborum, multo ante accessionem, per caput ægrum multa calida aqua perfundebat, deinde vinum dabat. Quod, quamvis pleraque ejus viri præcepta secutus est Asclepiades, recte tamen præteriit: est enim anceps.

XIV. If it is a tertian or quartan, which intermits completely, on the intermediate days, it is proper to have recourse to both walking and other exercises and anointing. One of the more ancient physicians, named Cleophantus, in this kind of disease, some time before the paroxysm, bathed the patient from over the head with a great quantity of warm water, and then gave him wine, which Asclepiades, however, has properly omitted, although he followed most of the precepts of that man: for it is doubtful (as to its good effect).

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